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MALKIEL (S.). **Immunochemical studies on Tobacco mosaic virus. II. The host–strain relationship. III. The specificity of preparations of two strains isolated from the sap and the fibrous residue of infected plants. IV. The serological behavior of sonic treated Tobacco mosaic virus.**—*J. Immunol.*, lvii, 1, pp. 43–65, 1 fig., 1 diag., 8 graphs, 1947.

The presence of antigenic determinants common to both the tobacco mosaic virus and the strain from ribwort [*Plantago lanceolata*: see below, p. 162] was confirmed by means of the quantitative precipitin technique. Immunologically independent determinants for each virus were also found. No serological difference was detected for either virus when each was isolated from widely separated plant species (tobacco and *Phlox drummondii*). Immunochemical studies failed to reveal normal host protein as a component of any of the virus preparations.

No significant difference in serological specificity was found by the quantitative precipitin technique between preparations of the tobacco mosaic and ribwort viruses isolated from the sap and fibrous residues of Turkish tobacco plants.

The rod of the tobacco mosaic virus was fractured by 20 minutes' exposure to the vibrations of audible sound waves [*R.A.M.*, xiv, p. 199]. The serological behaviour of unfractured, intact virus recovered in pellet form following this treatment was identical with that of the control. On the other hand, preparations of short rods obtained by the sonic treatment of the virus showed an enhancement of the antibody-combining capacity as compared with the control. This is attributed in part to the increment of exposed surface following fracture and in part to the closer packing of antibody molecules on the smaller fragments. Neither changes in serological specificity nor the presence of any new antigenic determinants could be detected in the fractured virus particles, denoting that the molecular configuration of the new surfaces exposed was identical with that of the original surface.

OSTER (G.), KNIGHT (C. A.), & STANLEY (W. M.). **Electron microscope studies of Dahlem, Rothamsted, and Princeton samples of Tobacco mosaic virus.**—*Arch. Biochem., N.Y.*, xv, 2, pp. 279–288, 2 figs., 1 graph, 1947.

The size distributions of the virus particles in samples from Dahlem (Berlin), Rothamsted (England), and Princeton (New Jersey) of Turkish tobacco hair cells infected by the tobacco mosaic virus were shown by electron microscope studies to be essentially identical, with a most common length of $280 \pm 8{\cdot}6$ mμ [*R.A.M.*, xxvi, p. 471 and next abstract]. There are various possible explanations for the existence of shorter particles, one of which is that they represent incompletely formed virus. The results of a preliminary electron microscope examination (*J. appl. Phys.*, xviii, p. 272, 1947) of the hair cell contents of plants infected only one day with the virus suggested that a higher percentage of short particles occurs in the early than in the later stages of infection. The few particles exceeding $280 \pm 8{\cdot}6$ mμ in length which appeared in the micrographs are probably aggregates of shorter ones [cf. *R.A.M.*, xxvi, p. 268]. The width of the particles under the

electron microscope was 15·2 mμ. The symptoms on the plants and the yields and isoelectric points of the purified virus were the same for all three samples.

KNIGHT (C. A.) & OSTER (G.). **The size of the particles of some strains of Tobacco mosaic virus as shown by the electron microscope.**—*Arch. Biochem., N.Y.*, xv, 2, pp. 289–294, 1 fig., 1 graph, 1947.

The size distributions of the virus particles in the hair cells of Turkish tobacco and of cucumber plants infected by eight distinct strains of the tobacco mosaic virus were similar in electron micrographs, the most common length for six strains, viz., ordinary, green aucuba, yellow aucuba, Holmes's masked, Holmes's rib grass, and J 14D 1, being 280±8·6 mμ, and for cucumber viruses 3 [cucumber green mottle mosaic virus] and 4 [? a strain of the same virus] 297±8·6 mμ. The particle width of the two last-named was 13±0·6 mμ as against 15·2 mμ, regarded as characteristic of the tobacco mosaic virus.

TAKAHASHI (W. N.). **Respiration of virus-infected plant tissue and effect of light on virus multiplication.**—*Amer. J. Bot.*, xxxiv, 9, pp. 496–500, 2 graphs, 1947.

The results of experiments carried out at the University of Rochester, New York, demonstrated that the respiratory rate of Turkish tobacco leaf tissue artificially infected with tobacco mosaic virus and kept in distilled water in the dark or in continuous light was lower than that of uninfected tissue [*R.A.M.*, xxii, p. 328]. The respiratory quotients of infected and uninfected tissue cultured similarly were not significantly different. More virus was produced in tissues cultured in continuous light than in continuous darkness; in one experiment virus increased progressively for eight days, but in another the virus ceased to multiply after the sixth day.

MATSUMOTO (T.). **Serological studies on the distribution of Tobacco mosaic virus in host plants. V. Measurements of virus at intervals after two months. VI. Further evidences for the presence of virus in the xylem. VII. Measurements of virus in flower clusters and capsules. VIII. Supplement to report VII, with special reference to the seeds of infected plants. IX. General conclusion. Addendum: further comparative studies on the seeds of healthy and mosaic-infected Tobacco plants.**—*Trans. nat. Hist. Soc. Taiwan* (*Formosa*), xxxi, 219, pp. 445–450, 1 diag., 1941; xxxii, 223, pp. 159–167; 226, pp. 257–266, 3 diags., 1942; xxxiii, 232, pp. 1–5; 241, pp. 279–284, 1943. [Japanese, with English summaries.]

Serological measurements of tobacco mosaic virus in tobacco plants at intervals exceeding two months after inoculation [*R.A.M.*, xxi, p. 352] showed the concentration in the foliage to be generally high, the lamina harbouring larger quantities than the midrib. The virus was found to enter the xylem and circulate freely through the wood parenchyma or the connective tissues between the vessels of the woody cylinder. It is usually present to some extent in the outer stem and petiole layers, but the cortex underlying the former contains little or none. Although the virus has been found in the pith in most of the preparations examined, it could not be clearly demonstrated even at an antigen dilution of 1:10. The virus tended to be more abundant in the petals than in the sepals, but this relationship was not uniformly maintained. In flowers with irregular dark and pale pink patches on the corolla, the latter are richer in virus than the former; hence the uniformly paler petals usually contain more of the infective principle than the patterned ones. The amounts of virus in the stamens and pistils are generally small, and the same applies to the peduncles, but the bracts carry larger quantities than the flower buds, which are about equal to the sepals and petals in this respect. The virus appears to increase in the ovaries during the process of fruit development, passing to the ovary walls

and the ovules. The occurrence of the virus inside the seeds was clearly demonstrated by the serological technique, though the distribution of the virus in the tissues has not been exactly determined. The fact that tobacco mosaic virus is not seed-transmissible in spite of its presence in the tissues of the seed may be due either to the inability of the virus to enter the embryo or to the inactivating effect of a certain substance, or substances, in the seed, particularly during germination. There was no evidence of the virus-antigen in seeds from healthy plants.

WALLACE (G. B.). **Kromnek disease.**—*E. Afr. agric. J.*, xiii, 2, pp. 103–106, 1 pl., 1947.

During 1947, two tobacco plants and two fields of sunflowers were discovered in the south-western area of Tanganyika Territory showing symptoms indistinguishable from kromnek (tomato spotted wilt virus), hitherto confined in Africa to South Africa and Southern Rhodesia [*R.A.M.*, xxiv, p. 252; xxv, p. 188]. During the year, accordingly, herbaceous ornamental plants have not been allowed entry into East Africa from countries in which the disease is endemic. The identification on tobacco was made by K. B. Louwrens and that on sunflowers by the author. Some of the latter were about 2½ months old, and about a third of these and a few older plants were affected. They were below normal size and the heads were either lacking or very small and characteristically bent over. The leaves and upper part of the stems were very hairy, and the stems showed dark stripes, especially on the side to which the head inclined. The vascular bundles were black. Splits were present in the upper stems and cracks in the petioles and veins of some leaves. The first symptoms appeared in the upper leaves; at the top of the plant the internodes were short and the leaves bunched. Many leaves were very small; many were distorted, some with blisters or bulges on the surface, and had yellowish or pale green interveinal areas or mottling. One leaf was vase-shaped.

Control measures which can be undertaken include burning affected material and refraining from moving living plants (including cuttings, tubers, and bulbs) from endemic to uninfected areas unless they are to be used as food. In South Africa susceptible crops in endemic areas are planted out at twice normal density [loc. cit.]; affected plants are removed as seen, and after four to eight weeks any excess plants are removed. Tobacco fields and their immediate vicinity are maintained as free as possible from all other growing plants, including weeds.

WOLF (F. A.). **Tobacco downy mildew, endemic to Texas and Mexico.**—*Phytopathology*, xxxvii, 10, pp. 721–729, 1 fig., 1 map, 1947.

An historical review precedes the author's observations on the occurrence of tobacco downy mildew (*Peronospora tabacina*) in the lower Rio Grande Valley and elsewhere in southern Texas and the contiguous part of Northern Mexico, where it is prevalent on *Nicotiana repanda* [*R.A.M.*, xxi, p. 5]. The morphology and dimensions of the oospores in the old necrotic tissues of the curled and distorted or otherwise deformed leaves of *N. repanda* were in complete agreement with those of *P. tabacina* in decaying cultivated tobacco foliage. Sporangia suspended in tap water and kept for three hours in a refrigerator produced germ tubes 10 to 20 times their own length.

Three factors may reasonably be held to account for the original outbreaks of tobacco downy mildew in the eastern States of the Union, namely, (1) the utilization of the lower Rio Grande Valley for citrus and truck crops has promoted the spread of *N. repanda* and coincidentally the growth of its parasite; (2) the extended cultivation of tobacco in the Georgia–Florida area has provided a stepping-stone in the progression of the pathogen from the endemic wild species in the west to cultivated tobacco in the east; and (3) the sporangial stage of the fungus is dispersed by air currents [ibid., xvi, p. 64].

HARRISON (A. L.). **The control of late blight in Tomato seed-beds under epiphytotic conditions.**—*Phytopathology*, xxxvii, 9, pp. 625–634, 1 fig., 1947.

In the destructive outbreaks of tomato late blight (*Phytophthora infestans*) in Florida in 1946 [*R.A.M.*, xxvii, p. 49], bi-weekly sprays of dithane D14–zinc sulphate–lime (2 qt.–1 lb.–½ lb.) and two different formulations of ethylene bisdithiocarbamate, viz., IN 5446 and He 178 (each at 1¼ or 1¾–100 gals.), gave consistently good control in the seed-bed. Phygon (1–100) was also effective in the one test in which it was included. None of the copper sprays proved equal to the foregoing, the pathogen being merely held in check until the beds became crowded with seedlings, when infection spread rapidly under favourable conditions. Dithane was injurious to the seedlings but IN 5446 and He 178 were innocuous, even when applied twice weekly soon after emergence.

IN 7331 (a formulation of manganese ethylene bisdithiocarbamate) at 1½–100, dithane–zinc sulphate–lime, phygon, and IN 5446, used as dips, all helped to reduce late blight losses in transplanting, especially in the case of plants previously sprayed in the seed-bed with dithane–zinc sulphate–lime or IN 5446.

CRANDALL (B. S.). **Cladosporium leaf mold of Tomatoes in the Peruvian Montana.**—*Plant Dis. Reptr*, xxxi, 10, pp. 358–365, 3 graphs, 1947. [Mimeographed.]

At the Tingo Maria Experimental Station, Peru, all tomatoes were destroyed at the onset of the wet weather in early October, 1944, by a combination of insect and fungal attack (probably *Cladosporium fulvum*) [*R.A.M.*, xxiv, p. 52; xxv, p. 96]. In 1945 epidemic losses recurred with the advent of wet weather. All the brown and wilted leaves bore abundant spores of *C. fulvum*, which spread over the entire lower surfaces, and was not restricted to localized lesions. The 1946 losses almost duplicated those of 1945. Circumstantial evidence indicates that insects play an important part in spreading the pathogen. The leaf mould appeared each year about 12 days after the end of the dry period, following 8 to 10 days of almost continuous rain.

Seed of resistant varieties received from the Agricultural Experiment Stations of Massachusetts, Ohio, Louisiana, and Ontario, and from the Bureau of Plant Industry of the United States Department of Agriculture, did not prove satisfactory. *C. fulvum* appears well adapted to the highland region of Peru. The Peruvian tomatillo [*Physalis ixiocarpa*] varieties were highly resistant or immune. Each year a few individual plants of susceptible commercial varieties, such as Marglobe, John Baer, and Rutgers Wilt-Resistant (which had been at the Station for some years) survived or had some resistance. Most of the progeny of the selections have been quite resistant. Selections of outstanding plants of each variety were made and their progeny were extremely resistant. Final trials of the varieties were planned for 1947. The selected progeny of the following varieties have been found highly resistant: Improved Bay State, Mold Resistant Waltham Forcing, Globelle (Ohio mould-resistant selection), Vetomold, Vetomold 121, Improved Vetomold 121, a Globelle type from Louisiana, and a Turrialba (Costa Rica) selection (31–0149–F5). These selections are being distributed throughout Peru for trial, and are now being introduced for small-scale plantings in the Tingo Maria area.

SCHROEDER (W. T.). **Control of Tomato diseases by spraying.**—*Bull. N.Y. St. agric. Exp. Sta.* 724, 28 pp., 4 figs., 1947.

In comparative spraying tests in western New York, carried out from 1944 to 1946, inclusive, against tomato early blight (*Alternaria solani*) [*R.A.M.*, xxv, p. 331; xxvi, p. 472], anthracnose (*Colletotrichum phomoides*) [loc. cit.], late blight (*Phytophthora infestans*) [ibid., xxvi, p. 428 and loc. cit.], and leaf mould (*Cladosporium fulvum*) [ibid., xxiv, p. 266; xxv, p. 334], no single fungicide gave maximum control

of all four diseases. The fixed coppers gave good control of leaf mould, early blight, and late blight, but were somewhat inferior to Bordeaux mixture (8–4–100) against early and late blight. The copper fungicides tested did not control anthracnose adequately, and all proved injurious in the early applications. Phygon [ibid., xxvi, p. 211] gave good control of early and late blight and anthracnose but caused fruit discoloration. Dithane D-14 [cf. ibid., xxvi, pp. 346, 441] and He 178 e (zinc ethylene bisdithiocarbamate) gave good control of early and late blight [see above, p. 164]. Zerlate [ibid., xxvi, pp. 36, 360, 426] was more effective than fermate [ibid., xxvi, p. 441], since it controlled anthracnose equally well and early blight and leaf mould better, but neither material was very effective against late blight.

The best control of all four diseases together resulted from alternate spraying with fermate or zerlate and various copper fungicides, the following being outstanding: zerlate (2–100) for the first, second and fourth, and Bordeaux mixture (8–4–100) for the third and fifth applications [ibid., xxvi, p. 269]. No injury appeared to result, probably because the Bordeaux mixture was not applied until after 1st August, after which time defloration, the principal injury factor, does not affect yield, unless the harvest is exceptionally prolonged.

URQUIJO LANDALUZE (P.). **La enfermedad de la 'tinta' del Castaño.** [The 'ink' disease of Chestnut.]—*Agricultura, Madr.*, xvi, 179, pp. 114–118, 9 figs., 1947.

The history of chestnut ink disease (*Phytophthora cambivora*) is summarized, studies on its etiology are briefly reviewed, and the problem of control is considered [*R.A.M.*, xxvii, p. 114]. The author, working in Spain, has found copper oxide superior to copper carbonate or copper oxychloride for application to the decorticated areas of the trunk and roots. An important economy is thereby effected, since the commercial brands of copper oxide, copper Sandoz and perenox, with a 50 per cent. copper content, are on sale at similar prices to the other two compounds, containing only 16 or 17 per cent. The mixture, consisting of 40 kg. copper carbonate or copper oxychloride, or alternatively 20 kg. copper oxide, and 40 kg. kaolin or gypsum, should be applied at a dosage of 250 to 400 gm. per tree.

HENRY (B. W.) & RIKER (A. J.). **Wound infection of Oak trees with Chalara quercina and its distribution within the host.**—*Phytopathology*, xxxvii, 10, pp. 735–743, 1 diag., 1947.

At Madison, Wisconsin, typical wilt developed and *Chalara quercina* [*R.A.M.*, xxv, p. 544; xxvi, p. 381] was reisolated from black oak (*Quercus velutina*) woodland seedlings and sprouts and from red oak (*Q. borealis*) greenhouse seedlings, all inoculated with the pathogen through wounds in the vascular tissues of the roots, stems, branches, twigs, and leaves. The outdoor tests were performed from 16th June to 13th July, 1943, and results were apparent early in the following September and the greenhouse experiments in April, 1942, and 1943, the data being recorded later in the same season.

The several isolates of the fungus from bur (*Q. macrocarpa*), red, and black oaks did not appear to be restricted in pathogenicity to their own hosts.

C. quercina was distributed throughout the crowns of the wilting trees, whether naturally infected or inoculated, including the non-symptomatic branches and foliage. The roots of over half the trees tested yielded the fungus. It was isolated from the current-year and one- and two-year-old wood of infected oak stems.

MILLER (P. W.). **Causes of decline and death of Filberts in the Pacific Northwest.**—*Proc. Ore. St. hort. Soc.*, xxxviii (*1946*), pp. 85–88 [? 1947].

In this lecture the author described in popular terms the contribution of several non-parasitic disorders, such as sun-scald, and the most important parasitic

diseases, bacterial blight caused by *Xanthomonas* [*Phytomonas*] *corylina* [*R.A.M.*, xxv, p. 372] and mushroom root rot (*Armillaria mellea*) to the decline and death of filberts [*Corylus avellana*] in the Pacific Northwest. The presence of various [unspecified] wood-rotting fungi, most of which are wound parasites, also contributes towards the decline and premature death of the trees.

WENT (JOHANNA C.). **Verslag van de onderzoekingen verricht in 1946 voor het comité inzake bestudeering en bestrijding van de Iepenziekte en andere boomziekten, uitgevoerd op het Phytopathologisch Laboratorium 'Willie Commelin Scholten' te Baarn.** [Report on the investigations conducted in 1946 for the committee acting in the study and control of the Elm disease and other tree diseases, carried out at the Phytopathological Laboratory, 'Willie Commelin Scholten', Baarn.]—*Meded. Iepenziektecomité, Baarn*, 42, 12 pp., 1947. [English summary.]

In 1946 inoculation tests were again performed on selected elm seedlings and grafts which had shown resistance to *Ceratostomella ulmi* in previous trials [*R.A.M.*, xxvi, p. 177]. Seven hybrids, derived from seven different crosses, remained free from infection during the period covered by the investigations, ranging from five to nine years. The parents used in these crosses were *Ulmus hollandica belgica*, *U.h. vegeta*, *U. horsholmensis* (*U. carpinifolia horsholmi* according to Melville in *J. Linn. Soc. Lond.*, liii, p. 83, 1946), *U. foliacea* No. 1 (*U. carpinifolia* according to Rehder in *J. Arnold Arbor.*, xix, p. 266, 1938), *U. foliacea* No. 28, *U. pumila pinnato-ramosa*, and *U. wallichiana*. Half the numbers tested remaining healthy after inoculation consisted of hybrids of *U. hollandica vegeta* × *U. foliacea* No. 1 and *U. foliacea* No. 28 × *U. foliacea* No. 1. Since 1940 14 per cent. of the grafts of *U. foliacea* No. 62, a French seedling, have contracted the elm disease, some in a mild form; eight of those showing symptoms in 1946 recovered completely in the autumn. The same variety proved very resistant in inoculation experiments with *Nectria cinnabarina*. The prospects of finding elms immune from *C. ulmi* in nature appear to be remote.

Picea abies trees in various parts of Holland have been suffering from a disease marked by the discoloration and shedding of the older needles, those of the current season being mostly healthy. The condition of 19 specimens in a sheltered area near Baarn kept under continuous observation remained stationary during 1946, but severe symptoms developed on 12 *P. glauca* trees in the vicinity. Two out of four isolations from *P. abies* needles yielded both a large- and a small-spored *Rhizosphaera*, presumably *R. pini* [*R.A.M.*, xv, p. 618] and *R. kalkhoffii* [ibid., xi, p. 136], respectively, while the former only was present in six out of 21 isolations from *P. glauca*. Material collected in other districts from similarly affected trees harboured only a species of *Phoma* (7 out of 21 isolations).

Phaeocryptopus gaeumanni was observed on Douglas fir (*Pseudotsuga taxifolia*) [ibid., xxvi, p. 367] during 1946, this being the first record of the disease for Holland.

A summary is given of S. J. Truter's studies on alder die-back, an extended account of which has already been noticed [ibid., xxvi, p. 516].

BAXTER (D. V.). **Some resupinate Polypores from the region of the Great Lakes. XVI.**—*Pap. Mich. Acad. Sci.*, xxx (*1944*), Part I, pp. 175–191, 14 pl., 1945.

Continuing his studies on the resupinate Polypores of the Great Lakes region of the United States [cf. *R.A.M.*, xxiv, p. 82 and next abstract], the author gives keys to the principal light-coloured and brown resupinates, i.e., those characterized, respectively, by a light-coloured and a brown mycelium in Petri-dish and one-year-old wood block cultures.

BAXTER (D. V.). **Some resupinate Polypores from the region of the Great Lakes. XVII.**—*Pap. Mich. Acad. Sci.*, xxxi (*1945*), Part I, pp. 117–130, 5 pl., 1947.

In his introduction to this further contribution to the present series of studies [see preceding abstract], the author states that his aim is to formulate as complete a record of the resupinate Polypores of the Great Lakes area of the United States as may at present be possible. A comprehensive treatment of the resupinate Polypores of North America is projected.

The present contribution discusses ten species and describes one new one. The fungi dealt with include *Polyporus amorphus* [*R.A.M.*, xviii, p. 335], which causes a rot of the sapwood of *Pinus rigida* (*Mycologia*, ix, pp. 261–270, 1917) and is found on *Abies balsamea*, *Picea engelmanni*, *P. sitchenis*, *Pinus ponderosa*, *P. strobus*, *Pseudotsuga taxifolia*, and other conifers in 11 States. This fungus may be confused with *Polyporus dichrous* because the tubes may appear waxy or resinous, but the mouths of *P. amorphus* are larger (2 to 4 as against 5 to 7 to a mm.) and its hymenium does not peel off in a thin, smooth layer in fresh specimens.

SMITH (J. H.). **Prevention of sap stain in Insignis Pine.**—*Aust. Timb. J.*, xii, 12, pp. 710–711, 729, 731–732, 1947.

In this article (reprinted from *N.Z. nat. Rev.*), the author, a member of the New Zealand Forest Service, recommends the following treatment for the prevention of sap stain [of unspecified origin] in insignis pine ([*Pinus*] *insignis*) timber. The most satisfactory method consists in kiln-drying at the mill, the logs being placed in filleted stacks within 24 hours of sawing and drying commenced within a few days. Where this is impracticable, one of the proprietary chemical anti-stain solutions should be applied to the timber, e.g., lignasan, santobrite, permatox 105, or noxtane (with a minimum content of 17 per cent. sodium pentachlorphenate, 48 per cent. borax, and 28 per cent. soda), at the low cost of 2d. or 3d. per bd. ft.

NORD (F. F.) & VITUCCI (J. C.). **On the mechanism of enzyme action. XXXI. The mechanism of methyl-*p*-methoxycinnamate formation by Lentinus lepideus and its significance in lignification.**—*Arch. Biochem., N.Y.*, xv, 3, pp. 465–471, 1 graph, 1947.

The wood-destroying fungus, *Lentinus lepideus*, produces methyl-*p*-methoxycinnamate [*R.A.M.*, xxvi, p. 517] from dextrose, xylose, glycerol, and ethyl alcohol. Ethyl alcohol, formed from dextrose, xylose, and glycerol, is dehydrogenated, as indicated by the discoloration of resazurin when incorporated in an alcohol medium. Acetaldehyde, the dehydrogenation product of ethyl alcohol, when trapped with dimedon, does not give rise to the synthesis of the ester, which does occur, however, on the omission of the trapping agent. Methyl-*p*-methoxycinnamate was shown by these studies to originate in the cellulosic fraction rather than in the lignin portion of the wood. The progress of lignification in wood, moreover, was found to be governed by the respective rates of the enzymatic carbohydrate degradation and the synthesis of methylated products.

FOSTER (H. H.). **The control of Cabbage downy mildew through the use of sprays.**—*Phytopathology*, xxxvii, 10, pp. 712–720, 1947.

In greenhouse inoculation tests for the control of cabbage downy mildew (*Peronospora parasitica*), using the Golden Acre, Copenhagen Market, and Round Dutch varieties, at the Truck Crops Branch Experiment Station, Crystal Springs, Mississippi [cf. *R.A.M.*, xxiv, p. 259; xxvi, p. 574], dithane B-11 (1 lb. plus ½ lb. orvus per 100 gals.), wettable spergon (4 lb. plus 1½ lb. vatsol O.T.C.), and Dow seed protectant No. 5 (2 lb. plus ½ lb. orvus) gave the lowest disease ratings of 0–1,

where 0 represents no sporulation and no apparent spray injury and 4 abundant and general sporulation and varying incidence of mortality, sometimes accompanied by severe spray damage. Dithane B-11, however, failed to eliminate infection in 1945 in outdoor seed-beds, in which the other two preparations again resulted in the minimum rating of 0–1. Two applications a week conferred adequate protection. Of the various emulsifiers and spreaders tested, orvus [ibid., xxiii, p. 372] and vatsol O.T.C. [ibid., xxi, p. 115] proved the most satisfactory.

In the outdoor trials the average number and weight of plants per sq. ft. and the average weight of 100 pulled at random were used in addition to the disease ratings as criteria of the efficacy of the various treatments. In 1945 the average numbers of 12-week-old Golden Acre plants per sq. ft. in the beds treated twice weekly with spergon and Dow No. 5 were 243 and 226, respectively, compared with 20 in the unsprayed, the average weight of plant tops per sq. ft. 115, 139, and 7 gm., respectively, and the average weight of 100 pulled at random 67, 87, and 7 gm., respectively. In January, 1946, the Round Dutch plants per sq. ft. in the beds sprayed with spergon and Dow No. 5 and untreated numbered 120, 99, and 93, respectively, the weights per sq. ft. were 343, 259, and 160 gm., respectively, and the 100-plant weights 625, 586, and 412, respectively, corresponding to disease ratings, of 1·5, 1·5, and 3, respectively. The figures for a third experiment taken in February, 1946, were for spergon on Golden Acre plants in chloropicrin-treated soil, 244 plants weighing 282 gm. per sq. ft. and 293 gm. per 100 plants, the corresponding figures for spergon with untreated soil being 164, 245, and 345, respectively, for Dow No. 5 and treated soil 137, 258, and 296, Dow No. 5 and untreated soil, 187, 265, and 285, and the unsprayed untreated control 148, 91, and 121, respectively.

Eddins achieved the best results in cabbage downy mildew control in Florida with a power spray delivering a minimum of 200 lb. pressure (*Proc. Fla hort. Soc.*, 1944), but such equipment is not regarded as essential in Mississippi, where hand and cart sprayers with a maximum of 50 lb. pressure should be quite adequate provided the treatments are started in good time and carried out regularly and thoroughly. Based on retail prices at the time of writing, the amount of spergon (4 to 7 gals.) required to spray 70 sq. yds. of seed-bed 12 to 15 times, necessitating a total of 100 gals. spray, would cost the grower roughly $4 to $5, or 17 cents per 1,000 plants. A bed of 70 sq. yds. should set at least 3 acres, reckoning 10,000 plants to the acre. Of late years cabbage plants have frequently sold at $2 to $4 per 1,000, so that spraying is an economical control measure.

Taylor (R. E.), Cronshey (J. F. H.), & Dillon Weston (W. A. R.). **Seed disinfection. VIII. Radishes.**—*J. agric. Sci.*, xxxvii, 4, pp. 267–269, 1947.

Although seed-borne disease is not known to be a factor in radish-growing, field experiments were conducted in the Sandy district of Bedfordshire to ascertain whether seed disinfection for very early sowings would increase stands. The results of preliminary trials in 1936 showed that treatment with methyl mercury phosphate in an inert filler or with a proprietary product C significantly increased emergence of seeds sown on 14th February, and for the round variety the former at 1 per cent. proved better than C. For the long variety there was a significant increase in emergence but not in final stand when another proprietary product A was used.

During further trials in 1945–6 two round varieties, Scarlet Globe and Crimson Globe, and a long variety were treated with A and a third proprietary dust H. Only a second trial in 1946 (Crimson Globe sown on 19th February) resulted in a significant increase in emergence; germination then coincided with very cold weather with frost and some snow. It is concluded that radish seed treatment is beneficial when adverse weather conditions are prevalent at the time of germination and advantages are, therefore, confined to early sowings.

Hull (R.) & Watson (Marion). **Factors affecting the loss of yield of Sugar Beet caused by Beet yellows virus.**—*J. agric. Sci.*, xxxvii, 4, pp. 301–310, 1 graph, 1947.

In field experiments carried out in 1942 at Hackthorn, Lincolnshire, and at Rothamsted Experimental Station, Hertfordshire, the effect of beet yellows virus [*R.A.M.*, xxvi, p. 520] on the yield of sugar beet was tested in relation to various manurial treatments.

Plants of the Kleinwanzleben E variety were colonized with infective aphids [? *Myzus persicae*] at the appropriate times. Results showed that plants on very fertile sites suffered much greater losses than on those of low fertility. The loss increased proportionately with the increase in yield. There is no evidence that fertilizers and manures decrease the incidence of virus infection, with the possible exception of phosphate to a very limited extent. Potash and agricultural salt tended to increase yellowing and ammonium sulphate leaf necrosis. Reddening was reduced by phosphate and potash.

Most fertilizers have little effect in determining spread of yellows infection; salt gives a small but constant reduction, but it also reduces the yields of infected plants. The different varieties, types, and pure line selections showed very little variation in susceptibility to, or tolerance of, yellows virus infection. No material was found with suitable qualities for breeding resistant or immune varieties.

Forsberg (J. L.) & Binkley (A. M.). **The effect of seed treatments, commercial fertilizers, and minor elements on root rot, stand, and yield of pod Peas.**—*Phytopathology*, xxxvii, 9, pp. 650–656, 1 fig., 1947.

The results of further experiments in Colorado in 1944 on the control of pea root rots (*Rhizoctonia* [*Corticium*] *solani*, *Pythium ultimum*, *Ascochyta pinodella*, and *Fusarium solani* var. *martii* f. 2) by seed treatments and soil amendments, using Laxtonian, Little Marvel, and Rogers's 95, generally corroborated those of the previous year [*R.A.M.*, xxiv, p. 47]. Dusting the seed with new improved ceresan, Du Pont 1452-F (both at 1 oz. per bush.), arasan, spergon [ibid., xxvii, p. 4], and yellow cuprocide (all at 2 oz.) usually improved the rate of emergence and increased production on uninoculated plots. No significant increase in emergence in pot trials, however, was obtained from any seed treatment when *F. solani* var. *martii* f. 2 was present in the soil, the Laxtonian variety being particularly susceptible to this pathogen, but Little Marvel was not significantly affected. Spergon and arasan were effective against *C. solani*, damage from which to Laxtonian and Rogers's 95 was also reduced by new improved ceresan. The death rate in Little Marvel due to *P. ultimum* was slightly decreased by spergon, arasan, and cuprocide, but the other two varieties failed to respond to treatment. *A. pinodella* was effectively combated by spergon and arason on Rogers's 95.

In greenhouse experiments to determine the reason for the inconsistent results of seed treatment tests in the 1943 field trials, the Wisconsin Sweet variety was grown in nine different soils, seven of which were collected in pea fields. Significant increases were obtained with new improved ceresan and spergon in five of the field soils but it appeared that factors other than seed treatment influenced the final stand.

The efficacy of the seed treatments was not increased by combinations of fertilizers, nor were stands or yields augmented by applications of copper, iron, zinc, or manganese to the soil.

Foster (H. H.). **Reaction to rust, under Mississippi conditions, of certain lines and varieties of pole snap Beans.**—*Plant Dis. Reptr*, xxxi, 10, pp. 378–383, 1947. [Mimeographed.]

This report deals with experiments conducted at the Mississippi Truck Crops Branch Experiment Station during the autumns of 1945 and 1946 in which 42

bean (*Phaseolus vulgaris*) varieties and lines were tested for their reactions to rust [*Uromyces appendiculatus*: *R.A.M.*, xxvi, p. 325; xxvii, p. 56]. In 1946 the rust development reached epidemic proportions owing to abundant rain. Only two lines remained free from infection, Virginia 119 in 1945 and No. 780 in 1946; No. 121 showed only a trace of infection in two seasons. During the two seasons the following lines showed resistance, with a disease rating of 1 (very slight infection on lower leaves, occasional trace on upper, no pod infection): Victory No. 2, Victory No. 4, Victory No. 6a, 110, 113, 122, and Alabama 19; slightly less resistant were 103, 104, 106, 107, 109, 114, 118, and 120.

It appears that several physiologic races of bean rust were present in the infected fields.

Cronshey (J. F. H.). **Sclerotinia porri on Allium spp. in England.**—*Nature, Lond.* clx, 4075, p. 798, 1947.

Crow garlic (*Allium vineale*), examined at Cambridge in June and July [? 1946], by Mrs. R. H. Richens, was frequently attacked by a species of *Botrytis*. Cultures of this fungus produced abundant, raised, fluffy, white mycelium, and after some delay a few conidia and small sclerotia. Many cultures also produced one or two large, raised, irregular, 'convoluted' sclerotia. Apothecia developed from these, and single-ascospore cultures produced *Botrytis* conidia.

Onions inoculated with the fungus developed a severe neck rot with numerous sclerotia and a mycelial felt, conidia being few or absent. Twice-subcultured inoculum carried in culture for three months did not induce the disease, indicating a loss of pathogenicity in culture.

Both the conidial and the apothecial stages of the fungus appear to be identical with *Sclerotinia porri* [*R.A.M.*, vi, p. 525] and the *Botrytis* stage also agrees with the published description of *B. byssoidea* [ibid., xxv, p. 92].

Greer (E. E.). **Borax corrects tipburn in greenhouse Lettuce.**—*Trans. Ill. Acad. Sci.*, xxxviii, pp. 19–20, 1945. [Received December, 1947.]

As Farm Adviser, Williamson County, Illinois, the writer recommended soil amendments of borax at the rate of 30 lb. per acre to greenhouse crops of lettuce severely affected by tipburn [*R.A.M.*, xii, p. 611; xxv, p. 535]. Following this advice, a grower applying the treatment before the second of the three plantings ordinarily made between 1st September and 1st May obtained an increased yield estimated at 10 to 20 tons per acre for a single crop. Continuous and intensive use of the soil over a 30-year period had undoubtedly caused a heavy withdrawal of available boron, which could not be rectified by treatment with manure from the home farm.

Wilson (C.). **Concealed damage of Peanuts in Alabama.**—*Phytopathology*, xxxvii, 9, pp. 657–668, 1 fig., 2 graphs, 1947.

Concealed damage of groundnuts [*R.A.M.*, xxvii, p. 60] causes a strong, rancid taste in affected seeds, associated with an increase in the percentage of free fatty acid, and renders them unfit for the confectionery trade. In 1945 the losses from this source were unusually heavy in Alabama, amounting to some $2,500,000.

Most of the infections, if not all, occur in the field before the groundnuts are dug, the extent to which the condition develops further being determined primarily by the method of curing. Thus, the average percentages of concealed damage in samples cured in (1) windrows, (2) symmetrical stacks, covered with a 'cap' of nuts that sheds water, (3) rough or uncapped stacks, and (4) 'cocks' (small to medium-sized heaps) were 0·25, 1·8, 3·6, and 5·7, respectively. The more rapid completion of the process in windrows than in stacks or 'cocks' evidently forestalls the development of infection. Further proof of the importance of the curing rate

in relation to concealed damage was afforded by the examination of samples from different parts of stacks and 'cocks', the incidence in the top and outside layers ranging from 0 to 1 per cent. and in the bottom and centre from 1 to 35. Damage does not develop appreciably until the moisture content is reduced to 35 per cent., and then appears most rapidly in groundnuts stored with a 15 to 25 per cent. moisture content, little progress being made in those with 10 per cent. or less at the time of storage or in those dried within four days. No particular soil type or fertilizer practice influences the amount of concealed damage, which does, however, appear to be more prevalent on land where the crop is continuously cultivated.

As previously reported [ibid., xxiv, p. 489], *Diplodia* [*Botryodiplodia*] *theobromae*, one of the imperfect states of *Physalospora rhodina* [ibid., xxii, p. 181], was the fungus most commonly isolated from damaged seeds, having been represented in 1,869 (87·2 per cent.) out of a total of 2,142 cultures obtained from 2,729 seeds in 1945 and 1946; 116 were *Fusarium* spp.; *Sclerotium bataticola* [*Macrophomina phaseoli*] was isolated from 28 seeds, *S. rolfsii* and *Rhizoctonia* from two each, while 125 cultures were composed of miscellaneous species, e.g., *Penicillium*, *Aspergillus*, and *Rhizopus*. Apart from *B. theobromae*, however, the organisms listed appear to be mostly secondary invaders after the seed reaches an advanced stage of decay.

The extent of concealed damage may be reduced by rapid curing. The use of windrows for this purpose cannot be recommended in Alabama owing to the risk of heavy and protracted rains, and small to medium-sized stacks should therefore be employed. Spanish groundnuts sustain little or no concealed damage compared with Alabama runners, while a measure of resistance to the defect has also been shown by the new Dixie Runner variety.

Garren (K. H.), Higgins (B. B.), & Futral (J. G.). **Blue-black discoloration of Spanish Peanuts.**—*Phytopathology*, xxxvii, 9, pp. 669–679, 1 fig., 1947.

A spotty or occasionally streaky, blue-black discoloration confined mainly to the testas of Spanish groundnut seeds, occurring sporadically in Georgia, is frequently responsible for down-grading. From the evidence so far available the affected seeds do not differ materially from healthy ones in flavour, chemical composition, or germinability. The defect is believed to result from an indicator reaction between the pigments of the seed coat and oxalic acid secreted by *Sclerotium rolfsii* [*R.A.M.*, vi, p. 439 and preceding abstract]. Field investigations indicated that the discoloration tends to develop as a sequel to the saprophytic growth of the fungus over the nuts in the curing process. When this is effected in warm, damp weather, the darkening develops on a high percentage of the cured seeds. Certain curing methods, contributing to moisture retention, e.g., the stacking of green, damp plants under a shed or in the field, also enhance discoloration. For instance, the percentages of blemished seeds in the samples treated in these two ways were 70·54 and 16·67, respectively, compared with 0 to 2·24 for wilted, dry plants stacked in the field, 0·55 for green, damp plants windrowed under a shed, and 0 for nuts on roots and green nuts only spread under a shed. Evidently, therefore, the most practical method of arresting or preventing the development of the blackening is the careful stacking of wilted plants and the acceleration of drying in stacks wetted during curing.

Sellschop (J.). **Groundnuts.**—*Fmg S. Afr.*, xxii, 258, pp. 705–712, 6 figs., 1947.

In this paper on groundnut cultivation in South Africa the author states that in the mist-belt areas the crop is often affected by leaf spot (*Cercospora* [*personata*]). Whatever rotation is practised, the stubble and trash of every crop in the rotation system should be ploughed in directly after harvest, otherwise *Sclerotium rolfsii* [*R.A.M.*, xix, p. 579; xxv, p. 199] may multiply on the trash. In the eastern Transvaal lowveld and along the Natal coast, where bacterial wilt

(*Bacterium* [*Xanthomonas*] *solanacearum*) [ibid., xxiv, p. 49] often occurs, groundnuts should not be grown in close rotation with other susceptible crops, and the more resistant Natal Common types may be grown in preference to Virginia Bunch. Seed should be dusted to protect it against *Rhizopus* spp. and other seed-destroying organisms.

Balakrishnan (M. S.). **Phytophthora palmivora Butler causing a seedling blight of Hibiscus esculentus L.**—*Proc. Indian Acad. Sci.*, Sect. B, xxvi, 4, pp. 142–146, 2 pl., 1947.

Seedlings of *Hibiscus esculentus* raised at the Agricultural Research Institute, Coimbatore, Madras, for inoculation experiments suffered from a severe collar rot and blight causing them to wilt and fall over. Infection was most active during rainy spells. Out of 20 isolations from infected seedlings 17 yielded a species of *Phytophthora* in pure culture, while in the remaining three *Rhizoctonia* [*Corticium*] *solani* was also present, presumably in a secondary capacity. The dimensions of the sporangia, zoospores, and chlamydospores of the former fell within the range of *P. palmivora*, to which the pathogen of *H. esculentus* is accordingly referred, this being apparently the first record of its occurrence on the host in question. Since no oospores were formed in pure culture after three months, paired cultures were made with known plus and minus strains of the fungus [*R.A.M.*, xxvii, p. 159]. The isolate from *H. esculentus* paired only with the former and is to be ranked, therefore, among the minus strains. The spherical or subspherical oogonia, provided with a rather slender stalk encompassed by the persistent amphigynous antheridium, ranged from 20 to 40 (average 30·5) μ and the oospores from 18 to 30 (23·5) μ in diameter; at maturity the walls of both organs were golden- to dark-brown.

Inoculation experiments with the fungus on *H. esculentus* seedlings, using the terminal bud method devised by Wiant and Tucker for *P. capsici* [ibid., xix, p. 513], resulted in severe die-back and rotting of the younger portions, followed by the death of the plants in 10 to 15 days. Seedlings raised from sterilized seed in infested soil also contracted the typical symptoms of the disease, succumbing in 13 to 17 days. Successful results were given, too, by the application of fragments of agar cultures to young and old fruits, which decayed within five days under bell jars.

Batisse (E. M.). **Contribution à l'étude d'une thérapeutique préventive possible du court-noué des Vignes.** [A contribution to the study of a possible preventive treatment for Vine court-noué.]—*Rev. hort., Paris*, N.S., xxx, 22, pp. 392–397, 2 graphs, 1947.

Following preliminary tests in 1943, the author carried out experiments in the neighbourhood of Versailles in 1944 and 1945 in which 657 vines affected with court-noué [*R.A.M.*, xxvi, p. 439] were treated with electro-negative colloidal complexes of various metals and their oxides in powder form. The compounds were introduced into holes in the stock at the site of the original graft. The results obtained showed that materials producing a definitely curative effect fell into two classes, those known to exercise a mainly physiological action and those known to have a mainly anti-pathogenic effect. The first group included compounds containing iron (ferrous and ferric), uranium, lanthanum, and manganese, and the second mercury, copper, zinc, and lead. It was also found that applications in June were less effective than those made in April. Improvement was less marked in severely than in moderately affected vines. The results were not always apparent in the first year and took longer to appear in severely than in moderately affected vines.

It is concluded that a serious attempt to control court-noué should now be made by planting only healthy and, if possible, resistant vines, taking all necessary

sanitary precautions, including insecticidal measures, trying chemical treatments along the lines adopted by the author, and experimenting with hormones and auxins.

MacFarlane (Miss C. S.). **The activity of the 'vlamsiekte' organism in soils.**—*Fmg S. Afr.*, xxii, 259, pp. 820–822, 1947.

A study of the soil organism causing 'vlamsiekte' disease [bacterial blight] of vines in South Africa (*Erwinia vitivora*) [*R.A.M.*, xx, p. 44; xxvi, p. 332] was carried out in 1946 in an experimental plot at Constantia. Newly planted vine varieties on Jacques roots, which had been in competition with fully grown, infected vines and had failed to thrive, were found to show signs of ill health below soil-level. Isolations from these cuttings in four cases yielded *E. vitivora*. When inoculated into healthy Sultana vines the organism gave typical symptoms of the disease. At the same time, bacteria were also obtained from leaves rotting on the ground and one-year-old prunings, a few cultures also being secured from two-year-old prunings.

Two-year-old potted Sultana vine plants on their own roots were treated with suspensions of the bacteria at intervals of seven days. One vine developed the disease, the organism being recovered from the portion just below soil-level, but not from the extreme base of the original cutting; it was also isolated from the roots about 2 in. below soil-level.

Bacteria belonging to the same group were isolated from soil; 11 of the cultures produced the disease in healthy vines, while the remainder, though closely related to *E. vitivora*, were not pathogenic to vines.

Positive isolations were also made from grape skins, residues, and stripped stalks from wine factories. Active bacteria were easily obtained from shade-dried skins and from the under layers of the sun-dried ones. Drying the stalks for periods up to nine weeks did not reduce the yield of positive cultures. Heating the material above 55° C. destroyed the bacteria.

The evidence so far obtained clearly demonstrates that the presence of *E. vitivora* in the soil is a potential danger to vines, because while the proportion of vines affected may be small, when the disease reaches the aerial shoot infection may be spread rapidly by pruning and cultural operations through a whole vineyard. The danger from the use of grape residues as manure is also real, and is not diminished by air-drying or keeping the material for several months before use.

Plant pathology.—*Rep. N.Y. St. agric. Exp. Sta., 1945–6*, pp. 37–48, 1947.

In this report [cf. *R.A.M.*, xxv, p. 330] J. M. Hamilton states that peach trees high in nitrogen and sprayed at fortnightly intervals throughout the summer to within two weeks of harvest required about 30 p.p.m. of sulphur in the sprays to receive adequate protection against brown rot [*Sclerotinia fructicola*: ibid., xxiii, p. 68; xxiv, p. 23; xxvi, p. 97]. It was found that three dustings would be necessary to give protection equivalent to that conferred by one application of micronized sulphur 3–100 with 3 oz. Grasselli spreader-sticker. Brown rot activity falls to a minimum at 50° F. during grading.

In a critical test against cherry leaf spot [*Coccomyces hiemalis*: ibid., xxv, p. 402], Montmorency trees sprayed with methasan (zinc dimethyldithiocarbamate) 1 in 100 with or without 1 pint orthex had finally the most foliage in the best condition. A mixture of Bordeaux (1–3–100) and micronized sulphur (3 in 100) gave excellent control, without the injury caused by Bordeaux mixture alone. COCS (copper oxychloride sulphate) 1–2–100 was much more effective than micronized sulphur 5–100 with 1 pint orthex, but caused more leaf bronze: the addition of orthex to COCS increased bronzing but significantly improved control.

Experiments are described by J. M. Hamilton and G. L. Mack on potted, greenhouse-grown [apple] trees to test the performance of the New York spray-duster

which is basically a Niagara Cyclone duster with a positive feed hopper and a 22 h.p. motor delivering an air current of 180 m.p.h. This spray-duster is especially suitable for applying the new organic fungicides.

D. H. Palmiter and J. M. Hamilton state that although the 1945 apple-growing season was very wet, with an average of 6 in. rainfall per month and a total of 19 distinct infection periods, dry wettable and flotation paste fungicides kept fruit infection by *Venturia inaequalis* [ibid., xxvi, p. 303] at under 10 per cent. Fermate (1½–100) [ibid., xxvi, p. 347] gave better protection than micronized sulphur (5–100) [ibid., xxvi, p. 342], preventing secondary attack late in the season. Leaf infection was reduced by five-sixths by ground sprays of elgetol (2 qts.–100).

D. H. Palmiter reports that sooty blotch [*Gloeodes pomigena*: ibid., xxiv, p. 266] of Kieffer pears was again controlled by one application of elgetol (3 or 4 qts. per gal.) at the green-tip stage, other dinitro materials being effective when used at a concentration of active ingredient equivalent to that in 1 per cent. elgetol. When this green-tip spray was omitted good control was given by using fermate (1 in 100) in the first three codling moth cover applications. Severe *Fabraea* fruit and leaf spot of pears [*F. maculata*: ibid., xx, p. 213] was controlled by four applications of fermate (1 in 100) and by wettable sulphur (5 in 100).

Tests by J. M. Hamilton and D. H. Palmiter demonstrated that placing fermate and dithane on the lower surface of the leaves of Rome Beauty apples protected the upper surface against [cedar-apple] rust [*Gymnosporangium? juniperi-virginianae*], though the reverse was not true. Partial covering of a growing leaf gave complete protection, a sprayed young leaf being protected until it became resistant.

R. O. Magie reports that investigations have now demonstrated that three treatments are necessary for the control of downy mildew [*Pseudoperonospora humuli*: ibid., xxv, p. 331] on Cluster hops in large gardens, (1) a spring application of 2 oz. calcium cyanamide spread evenly over each hill in a circle 18 in. diameter, (2) 10-day applications of an insoluble copper spray (about 2 lb. metallic copper per 100 gals.) beginning before the vines are first trained, and substituted by (3) home-made Bordeaux mixture (6–4–100) starting about 1st July. Three pounds of wettable sulphur should be added to each 100 gals. for the July and August applications to control powdery mildew [*Sphaerotheca humuli*: loc. cit.]; in gardens where severe attacks have been experienced, the sulphur should be added about the middle of June, using 5 lb. per 100 gals. Small gardens may be protected against downy mildew by dusting with copper-lime dust 20–80 or 25–75 in May and making five applications in June and July.

Data obtained by R. O. Magie and J. D. Harlan on the relative resistance to downy mildew and aphid injury of 202 hop seedlings and named varieties showed that in spite of the severe test afforded by the weather, Brewers Gold and Bullion, as well as some New York Station seedlings, produced a good crop without any spraying.

Further work by W. T. Schroeder indicated no difference, in general, between the fixed coppers as regards effectiveness against tomato *Alternaria* blight [*A. solani*: see above, p. 164], though Bordeaux mixture (4–2–50) appears to give rather better results, especially when infection is severe. There was no evidence that the Bordeaux mixture was more phytotoxic than the fixed coppers. The copper sprays gave the best control of *A. solani* and *Phytophthora* fruit rot [*P. infestans*: ibid., xxvi, p. 428] and, apparently, of leaf mould [*Cladosporium fulvum*], but did not control anthracnose [*Colletotrichum phomoides*: ibid., xxvi, p. 426]. Phygon (604) gave good control of *A.* [*solani*], *P.* [*infestans*], and anthracnose, but left a superficial blackening on the fruit. Fermate gave excellent control of anthracnose, was good for leaf mould, but gave poor results against *A. solani*. Zerlate gave excellent control of anthracnose and leaf mould and was comparable to the coppers for *A. solani*. In New York State, spraying must be designed to control simultaneously *A. solani*, *C. phomoides*, and *P. infestans*; in three widely separated areas fermate or zerlate

alternating with Bordeaux (4–2–50) gave a greater net return per acre than any of the materials alone or the alternate schedule of fermate and a fixed copper [cf. ibid., xxvi, p. 441].

W. T. Schroeder and G. E. R. Hervey report the results of tests with various dusts, including a DDT dust, on bacterial wilt [*Erwinia trachciphila*: ibid., xxvii, p. 109] of cucumbers and melons, seven weekly applications being made beginning at emergence and continuing until the first fruit began to form. On the China variety [host not stated] DDT gave outstanding control, while on Ohio 31 control was very good but there was severe stunting with reduced yield.

O. A. Reinking and W. O. Gloyer state that during the past ten years severe black rot [*Xanthomonas campestris*: ibid., xx, p. 331] has seldom occurred in the extensive cabbage areas in the Hall–Geneva–Phelps area, but in 1945 field infections ranging up to 85 per cent. were noted. In every case the disease was found to have spread from one infected seed-bed, the seed for which came from six different sources and all of it was reported to have received hot-water treatment. The seed-bed had been used for cabbage for three successive years. Proof was obtained that the infection came from the soil and not from the seed, since seed from the same source planted elsewhere gave healthy plants. Growers should accept only plants raised from treated seed in soil not planted with crucifers for at least three years.

In spraying and dusting trials by H. S. Cunningham against Lima bean [*Phaseolus lunatus*] downy mildew [*Phytophthora phaseoli*: ibid., xxii, p. 291] Bordeaux mixture (4–4–50) gave the best control.

H. S. Cunningham and O. A. Reinking found that seed piece decay due to *Fusarium caeruleum* and *F. sambucinum* f. 6 caused many poor stands of potatoes, some as low as 10 per cent., on Long Island. Treatment by the instant dip method with yellow oxide of mercury (1 in 30) or semesan bel (1 in $7\frac{1}{2}$) gave effective control.

Science for the Farmer.—*Rep. Pa agric. Exp. Sta., 1946–7* (*Bull.* 488), 57 pp., 15 figs., 1947.

In this report [cf. *R.A.M.*, xxvi, p. 188] J. B. Washko reports that in three years' tests Clinto oats have proved resistant to *Helminthosporium victoriae* [ibid., xxvii, p. 16]. During 1946, the yields of 84 potato varieties resistant to blight [*Phytophthora infestans*: ibid., xxvii, p. 34] grown under test by W. R. Mills ranged from 277 to 808 bush. per acre. Of mosaic-resistant tobacco strains [ibid., xxvii, p. 48] tested by O. E. Street, Pa 785 A, Pa 788, and Md 4 gave the highest yields. Pa 788 was notable for commercial quality and will probably be released to growers in another year. Pa R 5 A, resistant to both mosaic and black [root] rot [*Thielaviopsis basicola*: loc. cit.], was acceptable in most respects. In tests by the same worker in 1946 excellent control of blue mould [downy mildew, *Peronospora tabacina*: ibid., xxvi, p. 268] in tobacco seed-beds resulted from the use of dithane Z-78.

Further evidence was obtained by D. E. H. Frear that 'speed' sprayers [ibid., xxiv, p. 320; xxv, p. 254] give good coverage of the lower parts of apple trees, but do not cover the tops so well. Spray guns operated by hand and a mast sprayer gave uniform deposits over whole trees. The speed and mast sprayers are the most economical. A group of mazzard cherry [*Prunus avium*] trees in the Station grounds is reported by R. D. Anthony and W. S. Clarke to be very resistant to leaf spot [*Coccomyces hiemalis*: ibid., xxvi, p. 204]; seeds from these trees gave seedlings that also showed considerable resistance.

Annual Report of the Louisiana Agricultural Experiment Station, 1944–45. 144 pp., 21 figs., 2 maps, 1945. [Received January, 1948.]

In the Plant Pathology section (pp. 81–90) of this report F. J. Le Beau states that blight [*Cercospora thujina*: *R.A.M.*, xxiv, p. 298] of arbor vitae [*Thuja* spp.]

was controlled by three monthly applications of tribasic copper sulphate (4 lb. to 100 gals. water), dithane (2 qt. to 100 gals.), or Bordeaux (4–4–50) from the first week in June. A single Bordeaux spray in June also gave good control.

J. C. Miller, W. D. Kimbrough, and W. F. Wilson (p. 76) state that a strawberry seedling selected from Fairmore [loc. cit.] selfed has been named Marion Bell. It has been tested over three seasons and is field-resistant to leaf spot and scorch [*Mycosphaerella fragariae* and *Diplocarpon earliana*, respectively: loc. cit.].

In the course of preliminary tests in 1945 by S. J. P. Chilton and T. C. Ryker Rexoro and Blue Rose rice seed was treated with arasan and yellow cuprocide, soaked in water for 24 hours, and field sown in six inches of water. Plants from seed treated with yellow cuprocide showed earlier emergence and better stands than those from untreated seed or from seed treated with arasan in each of the three plantings made.

In areas where 'white tip' of rice [ibid., xxi, p. 128] was prevalent applications of a 10–10–0 fertilizer at 400 lb. per acre increased the yields by 4·6 barrels per acre, 300 lb. of a 13–7–0 fertilizer by 4·4, 200 lb. of a 20–0–0 by 2, and 200 lb. of a 10–10–0 by 2·2.

N. E. Jodon and D. J. Comeaux (p. 123) at the Rice Experiment Station made the following selections which are ready for final testing. No. 4–130, a mid-season selection, has shown some resistance to stem rot [*Leptosphaeria salvinii*: ibid., xxvi, p. 415]; mid-season to late selections 3–I–9–2–4 and 6–I–25–12 are very resistant to [unspecified] diseases and several selections from Blue Rose × Rexoro, backcrossed twice to Rexoro, are resistant to the new race [race 6] of *Cercospora oryzae* [ibid., xxvi, p. 261], to which Rexoro is susceptible.

According to L. H. Person, black rot of sweet potatoes [*Ceratostomella fimbriata*: ibid., xxvi, p. 528] is seriously threatening the industry in Louisiana and still spreading rapidly despite the use of healthy seed treated before bedding with standard protectants and the practice of a suitable three-year rotation.

On p. 138, T. T. Ayers, conducting the sweet potato disease investigations of the United States Department of Agriculture, states that of recently released sweet potato varieties, Pelican Processor was resistant to stem rot or wilt (*Fusarium batatis* [*F. bulbigenum* var. *batatas*] and *F. hyperoxysporum* [*F. oxysporum* f. 2]) [ibid., xxvi, p. 380] and only slightly susceptible to white rust (*Albugo* [*Cystopus*] *ipomoeae-panduratae*) [ibid., xxiv, p. 207].

L. H. Person and S. J. P. Chilton, investigating the use of spergon and arasan [ibid., xxvi, p. 347] as seed protectants, found that the percentages of seedling emergence for cucumbers were: untreated 31·2, arasan-treated 77·1, and spergon-treated 73·5, and for squash [*Cucurbita* spp.] 40·5, 82·6, and 80, respectively. The seedlings from treated seed 16 days after sowing were considerably larger than from untreated.

E. C. Tims reports that shallot yellow dwarf virus [ibid., xxv, p. 485; xxvii, p. 57], at present scattered over the entire shallot-producing area, is becoming widespread where seed sets are grown, as shown by the discovery of heavily infected plots of seed stock. During the spring of 1946 mildew [*Peronospora destructor*], not common on shallots, was very widespread in areas where it usually occurs on onions [ibid., xxvi, p. 436]. At that same time the worst epidemic of recent years developed on bulb onions and plants being grown for seed in the Lafourche area.

J. C. Miller reports that four Irish potato seedlings have remained free from spindle tuber [potato spindle tuber virus: ibid., xxvi, p. 165], although grown in close contact with diseased stocks for nine years.

In the course of cotton investigations for the United States Department of Agriculture D. C. Neal (p. 135) reports that some progenies of the Dixie Triumph hybrid resistant to wilt [*F. vasinfectum*: ibid., xxvi, p. 543] proved satisfactory in yield and resistance tests carried out during 1944–5 and that some of these strains

now seem ready for use in wilt-infested areas. Chemical analyses revealed that soil from an uninfected area was high in available phosphorus, potassium, and calcium with a near-neutral reaction of pH 6·9, whereas soil from an adjacent heavily infested area was extremely low in phosphorus, and 50 per cent. lower in potassium and calcium, with a pH range 5·2 to 5·7. Isolations from healthy soil, employing the dilution plate method, yielded several *Actinomyces* spp. and one bacterial organism, all of which show antagonism towards *F. vasinfectum* on agar plates. Infested soil yielded several *A.* spp., none of which has shown any pronounced antibiotic activity.

GAUGHRAN (E. R. L.). **The thermophilic micro-organisms.**—*Bact. Rev.*, xi, 3, pp. 189–225, 1947.

This review of the present state of knowledge concerning thermophilic micro-organisms, supported by 284 bibliographic references, deals with the terminology, classification, and characteristics of these bacteria, their origin and distribution, the explanation of their heat resistance and growth at high temperatures, the nature of their growth at high and low temperatures, and the temperature adaptation of these and other micro-organisms. The paper concludes with a brief reference to the harmful and beneficial activities of the thermophiles.

NOËL (CHRISTIANE). **Recherches anatomiques sur le 'crown gall'.** [Anatomical researches on crown gall].—*Ann. Sci. nat., Bot.*, Sér. XI, vii, 1, pp. 87–145, 3 pl., 47 figs., 1946.

The first section of this paper outlines, with numerous references, the present knowledge of the crown gall organism (*Phytomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xxvi, p. 536], describing its penetration into the host tissues and the history of anatomical researches, including the origin and growth of crown gall tumours and their anatomy.

In the present investigations [cf. ibid., xxv, p. 62] leaves of *Sedum telephium* and leaves and stems of *Pelargonium zonale* and *Ricinus communis* were infected with the organism by either needle inoculations or brush smears [loc. cit.], the anatomical structure of the neoplasms being afterwards studied from stained tumour sections.

The results, some of which have been reported elsewhere [loc. cit.], showed that *Bact. tumefaciens* could gain entry into the tissues either by way of the minute lesions which resulted from passing a paint-brush over the leaves or stems, or through the stomata, although the infection by either means was of comparatively short duration. Stem inoculations caused a much greater activity in the cambium than in the other tissues, resulting in the formation of the libero-ligneous zones, peculiar to crown gall tumours, continuous with those of the stem. It is believed, however, that the proliferation in the normal cambium of a stem plays only a very small part in the formation of tumorous tissues, because the tumours induced by superficial smears develop without its intervention. Nevertheless their small size is probably due to the absence of this connexion. In leaf tumours the epidermis and mesophyll both contribute to the formation of a parenchymatous mass in which the generative zones develop.

The formation of giant cells results from an antagonism between growth and cell multiplication; the cells of one tumour react differently, some showing an excess of growth and others of cell multiplication. The action of *Bact. tumefaciens* is distinguished from that of heteroauxin by its irregular promotion of root neoformations, and in its ability to cause proliferation in highly differentiated tissues, whereas the acid can induce it only in meristems or slightly differentiated parenchyma. The author considers, however, that her anatomical studies support the auxin hypothesis.

De Ropp (R. S.). **Plant tumours and animal cancer.**—*Nature, Lond.*, clx, 4075, pp. 780–782, 1947.

This paper summarizes previous studies on crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xxvi, p. 442], bacterial-free tumour growth, wound tumour virus (*Aureogenus magnivena*) [ibid., xxvii, p. 24], and the *Nicotiana* hybrid tumour [ibid., ix, p. 797; xiii, p. 565] and their relationship to each other and to animal cancers. The author concludes that there are three factors, viz., virus, hormone, and genetic, which may act singly or in combination to produce pathological growth.

Posnette (A. F.). **Virus diseases of Cacao in West Africa. I. Cacao viruses 1A, 1B, 1C, and 1D.**—*Ann. appl. Biol.*, xxxiv, 3, pp. 388–402, 2 pl., 1 map, 1947.

Descriptions are given of the symptoms caused by four virus strains associated with cacao swollen shoot on the Gold Coast [*R.A.M.*, xxvi, pp. 384, 538]. Strain A (*Theobroma* virus 1A, *Marmor theobromae* var. A) [ibid., xxv, p. 440] produces swellings on the fan and chupon branches, on the tap and lateral roots, and sometimes conspicuous ones on suckers arising from the base of the trunk. The swellings may be nodal or internodal, but are often terminal and associated with death of fourth-order veins, veinbanding of tertiary or fourth-order veins, opaque yellow or yellowish-green areas, and transparent, pale yellow or white lesions, which may become necrotic as the leaf matures. Shortly after infection, the green (unripe) pods develop a dark green mottle. In later stages this is overlaid by dark red marbling or blotches, the surface becomes smoother, and the pod is rounded. When the pod ripens to yellow, the green mottle persists. Affected pods are small and contain about half the weight of beans of a normal pod; the beans are flatter than normal, often with pale cotyledons. Plant vigour is markedly reduced. Root transmission by grafting has been obtained.

There is a mild or attenuated form of strain A [ibid., xxv, p. 294] which seldom causes swellings; when present, these are usually internodal on fan branches and so small that they resemble slight constrictions at the nodes. Leaf symptoms are mostly inconspicuous and confined to one or two leaves. In the first flush of leaves after infection the yellow veinlet-banding and flecking resembles the preliminary symptom of strain A, but later flushes rarely show more than a faint fern pattern. The fine-grain mosaic and transparent lesions of virulent strain A are seldom present, and when they are, the mosaic is composed of pin-point, yellow dots. Red veinbanding is faint or absent. There are no pod symptoms. Leaf-shedding and dieback are not present, and there seems to be little, if any, reduction of leaf size or growth rate.

Strain B (*Theobroma* virus 1B) [ibid., xxv, p. 441], transmitted by *Pseudococcus njalensis* and *Ferrisia virgata* [ibid., xxv, p. 547], causes more pronounced swellings than strain A on the branches and roots, which are usually more elongated in proportion to their diameter. Growth of the apical bud is sometimes checked, but it usually continues, masking or obliterating the swelling. Leaf chlorosis has not been observed in natural outbreaks, but occurs in experimental transmissions.

Strain C (*Theobroma* virus 1C?) or cacao mottle leaf [ibid., xxv, p. 441] is transmitted by *P. citri*. It appears to cause no swelling, and the leaf symptoms are less various than with strain A. The preliminary symptom of fine vein-clearing is similar, but the accompanying yellow veinbanding is usually more conspicuous. The leaves of subsequent flushes do not show yellow veinbanding, but present a conspicuous yellow mottle between the secondary veins, leaving broad, dark green bands along each side of the midrib and of the secondary veins. In the areas bounded by the green bands the chlorosis appears to be unrelated to the finer veins, no reticulate mosaic being produced. The chlorotic areas vary in degree of transparency, tending to complete clearing in the centre and opaque yellow at the edge

Necrosis of the clear lesions, resulting in ragged edge or shot hole, is prevalent on certain clones. Downward rolling of the leaf edges and intervenal crinkling is more severe than with strain A. The red veinbanding in the young leaf differs from that of strain A in that the red bands are much wider and often confined to the secondary veins. Sometimes the red pigment occurs as a wash or mottle over most of the lamina; it also persists for some time after the leaf is mature, intensifying the green, so that a two-tone green mottle results. The pods of some affected trees show a faint red blotching, and pod size may be greatly reduced. The effect of strain C on most trees is extremely debilitating.

Strain D (*Theobroma* virus 1D) [loc. cit.] is transmitted by *P. citri* and *P. njalensis*. It seldom causes swellings, though they occur occasionally as slight internodal inflations near the tips of fan branches. The preliminary symptom (clearing of fine veins) is uncommon, the first symptoms generally consisting of pin-point yellow spots evenly distributed over the leaf. As the leaf matures the spots become masked and are almost invisible. In later flushes, only a few leaves show any symptoms, and these consist of a distinctive mosaic of fine, yellow dots and larger cleared flecks. This 'pepper and salt' mosaic is evenly distributed over the lamina in the acute phase and gradually becomes concentrated in the course of successive flushes between the secondary veins, leaving these and the midrib banded with green. It may recur in the chronic phase (in addition to a fern pattern indistinguishable from that of strain A) with the transparent flecks adjacent to the midrib or secondary veins. In young leaves, the distribution of red pigment resembles that of strain C, but there is no narrow banding of the fine veins as with strain A. Leaf necrosis is seldom seen, but in the acute phase, cleared lesions may become necrotic. There appears to be a small reduction in leaf size.

Crowdy (S. H.) & Posnette (A. F.). **Virus diseases of Cacao in West Africa. II, Cross-immunity experiments with viruses 1A, 1B, and 1C.**—*Ann. appl. Biol.*, xxxiv, 3, pp. 403–411, 2 graphs, 1947.

In experiments on cross-immunity reactions between cacao viruses 1A, 1B, and 1C in the Gold Coast [see preceding abstract] a field trial involving three acres of graft-inoculated trees showed that virus 1B conferred some degree of protection against 1A [cf. *R.A.M.*, xxv, pp. 294, 441]. This protection appeared to be more effective against insect inoculation than against graft transmission, being only temporary in the latter case. Virus 1C gave no protection against 1A.

Inoculation experiments started in 1942 showed that 1A reduced yield by 50 per cent. in the first year after inoculation, and killed the trees in the second. Virus 1B had no appreciable effect on yield and 1C reduced it by 50 per cent. in the third year after inoculation, but caused no further decline in the fourth [loc. cit.].

Since virus C does not protect against virus 1A it should not be regarded as a strain of cacao swollen shoot virus (*Theobroma* virus 1) but as a distinct virus, the mottle-leaf of cacao, though the writers recommend the use of the name virus 1C until the relationships with the other cacao viruses have been investigated more fully and the classification can be reviewed.

Oswald (J. W.). **Fungi causing root rots of cereals in California.**—Abs. in *Phytopathology*, xxxvii, 11, p. 845, 1947.

Isolations covering a six-year period revealed the implication of eight pathogenic fungi in the cereal root-rot complex [cf. *R.A.M.*, xxvii, p. 136], which has been observed in 114 fields of 16 counties of California. Wheat and barley are commonly attacked, in decreasing order of apparent importance, by *Helminthosporium sativum*, *Gibberella saubinetii* [*G. zeae*], *Fusarium culmorum*, *Ophiobolus graminis*, and *Calonectria graminicola*. *Pythium graminicola* and *Sclerotium rolfsii* occurred

locally on barley and *H.* [*Pyrenophora*] *avenae* on oats. The seedling blight and adult root rot phases of the five common parasites are severe on wheat and barley, but oats are tolerant of all except *F. culmorum*. *H. sativum* and *G. zeae* are frequently found in association in the same field and often in the same host. The perithecia of the latter fungus have only once been detected in the field, probably owing to insufficient humidity when temperatures are high enough for their development. The absence from the State of wheat or barley scab is accounted for by lack of ascospore inoculum and inadequate moisture at heading time. *Wojnowicia graminis* [ibid., xvi, p. 242; xvii, p. 305; xx, p. 249; xxvi, p. 388], *F. equiseti*, and *F. scirpi* [ibid., xxiv, p. 143], though often present on diseased plants, have proved to be only of secondary importance.

Angell (H. R.). **The influence of fertilizers on take-all of Wheat.**—*J. Coun. sci. industr. Res. Aust.*, xx, 3, pp. 372–378, 1947.

In further studies on wheat take-all (*Ophiobolus graminis*) in Australia [*R.A.M.*, xxv, p. 210; xxvii, p. 14] carried out in 1943, the effects of soil nutrients on the host, on infection, and the development of the disease were investigated. A field with take-all history [loc. cit.] was divided into blocks of eight plots. In each block a mixture of trace elements was applied to one plot and the same trace elements and superphosphate (5 cwt. per acre) to another, ammonium sulphate (8 cwt.) being applied to one half of each plot. One plot was without any added fertilizer and the remaining five were given, respectively, superphosphate (5 cwt.), ammonium sulphate (8 cwt.) with and without superphosphate, and blood manure (8 cwt.) with and without superphosphate. The trace element mixture comprised 12 lb. zinc sulphate, 12 lb. manganese sulphate, 3·6 lb. copper sulphate, 0·6 lb. borax, and 0·6 lb. ammonium molybdate per acre.

The results demonstrated that the application of a mixture of ammonium sulphate and superphosphate, with or without trace elements, was generally beneficial, as shown by a significant increase in the number of ears per plant and the relatively small percentage of whiteheads, complete or incipient. In none of the treated plots, however, was the percentage of plants with healthy roots significantly different from the untreated, but this percentage was significantly higher in the plots receiving trace elements plus superphosphate plus ammonium sulphate (33·57), superphosphate plus ammonium sulphate (19·25), and blood manure (20·32) than in those receiving ammonium sulphate only (7·9) and trace elements only (7·7). A high average number of ears per plant was associated with the high percentage of healthy roots. On the plots given trace elements with ammonium sulphate the low percentage of whiteheads (0·45) was in marked contrast with the high percentage in the corresponding plots receiving ammonium sulphate only (13·15) and those given trace elements only (46·57).

It is clear that in these experiments root infection by *O. graminis* occurred very generally, and almost independently of ordinary fertilizer treatments. Disease development as estimated by the percentage of empty or nearly empty heads was, however, closely associated with soil treatment. The difference between the percentage of plants with root infection and that with diseased heads is, therefore, an indication of host susceptibility modified by the different soil treatments. It is concluded that in years or areas where soil moisture is not a limiting factor [loc. cit.] control depends on natural resistance associated with proper nutrition.

Reed (G. M.), Stanton (T. R.), & Wilds (G. J.). **Reaction of Oat varieties and selections to physiologic races A–30 and A–31 of loose smut.**—*J. Amer. Soc. Agron.*, xxxix, 12, pp. 1077–1087, 1947.

Of the two physiologic races of loose smut of oats (*Ustilago avenae*) used in the present extensive investigations on varietal reaction, A–30 has already been

described [*R.A.M.*, xxi, p. 251]. A–31 was collected in 1943 in South Carolina on Victoria and some hybrid selections from crosses in which this variety was one of the parents. Both races have been found to be highly pathogenic to a large number of varieties and selections hitherto regarded as resistant to loose smut, e.g., Tennessee 090 (Winter Fulghum) × Victoria, Fulghum × Victoria, Fultex, Quincy Red (Quincy 1), Hairy Culberson × Victoria, and (Victoria–Richland) × (Lee–Victoria) [cf. ibid., xxvii, p. 16]. Among the highly resistant combinations, on the other hand, were (Green Russian–Bond) × Lee–Victoria, (Markton–Fulghum) × (Victoria–Fulgrain), four varieties derived from Nortex × Victoria, viz., Carolina Red, Ranger, Rangler, and Rustler, and two selections, C.I. Nos. 3534 and 3535, Coker 41–12, a selection from Alber × Coker 32–1, C.I. Nos. 3943 and 4436 from Norton × Bond, Camellia (Alber × Bond), Coker 41–4, a selection from Bond × (Victoria–Fulgrain), Cape × Coker 32–1, four varieties derived from Iowa D 69 × Bond, i.e., Benton, Clinton, Cherokee, and Sac, and one selection, C.I. No. 3663, Coker 42–40 (Fulgrain × Capa), Boone, Cedar, Control, Tama, and Vicland (Victoria × Richland), Neosho, Osage, and Ventura, proceeding from (Victoria–Richland) × Fulton type, and Verde, from the cross Red Rustproof × (Victoria–Richland). A few of the varieties resistant to A–30 and A–31 are susceptible to the 'Victoria race' recently reported from Kansas [ibid., xxv, p. 554].

Races A–30 and A–31 may be readily differentiated by the reactions of 12 tester varieties, of which Hull-less, Traveler, and Tristerma were immune from A–30 but contracted 95, 88, and 100 per cent. infection, respectively, by A–31. Danish, Joanette, Liberty, and Rossman were immune from A–31 but sustained 82, 43, 81, and 63 per cent. infection, respectively, on inoculation with A–30. The comparative percentages on the remaining varieties, Danish Island, Gothland, Monarch, and Bicknell, were 68 and 4, 47 and 8, 86 and 6, and 5 and 100, respectively.

None of the known races of *U. kolleri* appears to be pathogenic to the newly developed Lee × Victoria varieties and selections.

Litzenberger (S. C.) & Murphy (H. C.). **Methods for determining resistance of Oats to Helminthosporium victoriae.**—*Phytopathology*, xxxvii, 11, pp. 790–800, 4 figs., 1947.

Of the various methods for the greenhouse and nursery inoculation of oats with *Helminthosporium victoriae* [see above, p. 175] compared at the Iowa Agricultural Experiment Station in 1946, mycelial suspensions of the fungus proved to be the most uniformly satisfactory in inducing heavy infections in susceptible varieties, e.g., Victoria, Vicland, and Cedar. The basic suspensions and 50 and 5 per cent. dilutions of them, with or without the agar, applied with the seed at sowing, on the surface of the soil after emergence, or as a spray on the seedlings, permitted no survival in the susceptible varieties, while not appreciably damaging the resistant Clinton. Incubation in a moist chamber for 36 hours was necessary in the case of applications to the soil surface or as sprays on the plants.

Seed moistened with the basic suspension, dried at once, or incubated at room temperature for 20 hours, planted immediately or stored for varying periods up to more than four months also gave equally satisfactory results in both greenhouse and nursery trials.

In the greenhouse, when contaminated straw was broadcast over the soil surface or on moistened emerged plants at the rate of one teaspoonful per pot then placed in the moist chamber for 36 hours, no survival of susceptible plants occurred. On the other hand, dusting the seed with infested straw at sowing resulted in the survival of some susceptible plants with every inoculation in the greenhouse and field. Therefore, when clear-cut differences are necessary in a critical study of varietal resistance or susceptibility to *H. victoriae* the use of culture suspensions for inoculation is preferable. However, in field tests of large numbers of varieties

or selections, where less exacting standards suffice, ground infected straw may be sown with the seed.

Some methods of inoculation, as indicated above, reduced the emergence of susceptible varieties by up to 100 per cent. and slightly depressed that of resistant ones; the latter, however, recovered and made normal growth, while the former seldom progressed beyond the primary leaf stage. Germinated seeds of resistant varieties that failed to emerge showed no evidence of infection. Percentage survival, therefore, is the best criterion for the evaluation of the relative resistance of oat varieties to *H. victoriae*.

Down (E. E.) & Thayer (J. J.). **Eaton Oats.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxix, 3, pp. 190–193, 1 fig., 1947.

The Eaton oat variety [*R.A.M.*, xxvii, p. 15], recently introduced to Michigan farmers, was developed from a cross between Bond and Iogold. It is resistant to the same forms of stem [black] rust [*Puccinia graminis*] as Vicland and Marion, has the crown rust [*P. coronata*] resistance of Clinton, and is resistant to smut [*Ustilago avenae* and *U. kolleri*] and *Helminthosporium victoriae* [see preceding abstract]. In trials in central and southern Michigan, Eaton and Clinton yielded equally well, with 87·9 and 85·9 bush. per acre, respectively.

Garrett (S. D.) & Buddin (W.). **Control of take-all under the Chamberlain system of intensive Barley growing.**—*J. Minist. Agric.*, liv, 9, pp. 425–426, 1947.

The requirements for the effective control of take-all (*Ophiobolus graminis*) of spring-sown barley [*R.A.M.*, xx, p. 568; xxiv, p. 177] under continuous cultivation appear to be met by the system devised by F. P. Chamberlain. This consists in the sowing of barley together with 10 lb. trefoil (*Medicago lupulina*) and 10 lb. Italian rye grass [*Lolium multiflorum*] per acre. The last two generally show a good growth in autumn after the barley harvest and are ploughed in during the late autumn or early winter. They use up all soil nitrogen, thus killing the take-all fungus. By the time the next barley crop is sown the nitrogen is freed again by decomposition. Thus, the two important requirements for the control of the disease are achieved: nitrogen low between crops, and nitrogen high during its growth. For the best results in the control of take-all two slight modifications are recommended: the rye grass (which, in the early stages, can act as a carrier of *O. graminis*) should be replaced by *M. lupulina* at 20 lb. per acre unless clover stem rot (*Sclerotinia trifoliorum*) [ibid., xxvi, p. 60] is likely to develop, when Chamberlain's seed mixture is preferable; the trefoil should be ploughed in later in the season, preferably in the next year.

Dillon Weston (W. A. R.), Large (E. C.), & Earnshaw (F.). **A disorder of Barley ears in East Anglia, 1947.**—*J. Minist. Agric.*, liv, 9, pp. 417–421, 4 figs., 1 graph, 1947.

In early July, 1947, an unusual disorder of spring-sown barley was observed in East Anglia and the eastern Midland counties. The spikelets of the affected plants showed a wide yawning of the glumes in clearly defined groups, usually at the tips but sometimes in the middle or at the base of the ear. The affected spikelets, which were of normal colour and shape, remained blind and closed up at the end of July. In the flowers of the yawning spikelets the three stamens were wholly or partially in the shape of ovaries and failed to produce pollen. This swelling of the stamens caused characteristic yawning of the glumes.

The incidence of blindness in 170 crops of Spratt Archer, the variety most severely affected, taken in relation to sowing date (the severity being assessed as slight up to 2 per cent., medium 3 to 7, severe over 7 per cent. blind spikelets per crop), was, for those sown up to 7th April, slight in 18 crops, medium in 10, severe in 1; 8th to 21st April, 36, 45, and 16; and after 21st April, 22, 14, and 8, respectively. Crops

of other early varieties most severely affected were also those sown between 8th and 21st April. It is presumed that the cause of the disorder is physiological and was due to the abnormally high temperature at the end of May and beginning of June, when the final flowering stages of some crops of spring barley were in progress.

CALAVAN (E. C.). **The incidence and development of Lemon shell bark.**—Abs. in *Phytopathology*, xxxvii, 11, p. 843, 1947.

Two types of pre-lesion symptoms of shell bark have been observed about midway through the cortex of Eureka and Lisbon lemon trees [in California: *R.A.M.*, xxvi, p. 394]. Brown, necrotic spots, 0·5 to 3 cm. long, impregnated with a hard, gummous substance, commonly precede 'slow' shell bark lesions, while 'fast', rapidly spreading areas frequently originate over thin tangential plates of discoloured phloem. The cells of these plates appear to contain substantial gum deposits. Streaks of discoloured phloem extend vertically from a plate ahead of the expanding lesion. New lesions generally form during a flush of growth, especially from February to May, and crack several months later. Numerous species of fungi have been isolated from the margins of advancing lesions, but none in 700 incipient ones. The disease is probably attributable to a virus or physiogenic factors.

BOUGHEY (A. S.). **The cause of variation in the incidence of blackarm disease of Cotton in the Sudan Gezira.**—*Mycol. Pap., Imp. mycol. Inst.*, 21, 7 pp., 2 graphs, 1 map, 1947.

The relationship has been investigated of the date of the first appearance and incidence (recorded at the Gezira Research Farm each year since 1934) of blackarm of cotton (*Xanthomonas malvacearum*) [*R.A.M.*, xxvi, p. 244] to the amount and season of rainfall. The sowing date of the main Farm crop each year has always been within one or two days of 15th August. Each year, during the first fortnight in November, the leaf incidence of blackarm was assessed on a scale where 0 signified no infection and 7 the maximum. The average of several random samples taken over a 20-acre area determine the figure for each of the 12 record areas.

A positive correlation was found to exist between blackarm incidence and the combined September and October rainfall, taking all twelve areas together, and also in the three southern areas together. There was also an independent positive correlation with June rainfall in these three areas but in neither case did the correlation reach statistical significance. The period elapsing after sowing before the appearance of blackarm showed significant correlation only with the June rainfall.

The local dissemination of the disease in the Gezira has already been found to be largely dependent on the frequency of rainstorms [ibid., xvi, p. 247] which usually occur during the September to October period. In the southern area of the Gezira it is believed that the effect of the June rainfall is to increase the amount of disease present before the September–October rains by increasing the numbers of infected volunteer seedlings. When June rainfall is heavy, more volunteer seedlings are established early and blackarm has a greater likelihood of spreading among them. Because the amount of June rainfall decreases rapidly north of Wad Medani, it is probably too light in the North Gezira to stimulate germination and maintain volunteer seedlings and hence the lack of correlation there. The various rainfall-blackarm correlations are important, first, because probable severity of blackarm attack south of Wad Medani can be forecast six weeks before the cotton crop is sown, secondly, the efficiency of the control measures in use can be checked, and lastly, they may furnish an explanation of the depressing effect on yield of rainfall at certain times. The sowing date of a crop may be postponed a fortnight when a heavy blackarm attack is forecast for a given area. This is most desirable where a high June and low July rainfall are combined. After several unexpectedly severe

and early blackarm outbreaks occurred in 1943 an investigation revealed that the disease organism was still present on the seed obtained from the Ghash area, although it had been treated, as usual, with abavit B. The unusual succession of two years of abnormally low rainfall during June and September to October was the primary cause of the unprecedented reduction in blackarm severity throughout the Gezira Scheme in 1941 and 1942.

Boughey (A. S.). **The causes of variation in the incidence of Cotton leaf curl in the Sudan Gezira.**—*Mycol. Pap., Imp. mycol. Inst.*, 22, 9 pp., 1 graph, 1 map, 1947.

In order to determine the reason for the annual outbreaks of cotton leaf curl [virus: *R.A.M.*, xxvi, p. 451] on the susceptible Sakel variety in the northern part of the Gezira area of the Anglo-Egyptian Sudan, the annual leaf curl incidence records for nine areas in the Gezira scheme, kept almost continuously from 1933 to 1944, were examined statistically in relation to the rainfall. In March, when leaf curl infection reaches its maximum, incidence for the current season was assessed by taking the percentage of infected plants in the area under investigation. This figure was obtained by averaging the counts for several random rows. The highest correlation was found between the March incidence and the combined April–May rainfall of the previous year; the correlation with May rainfall was also significant, but only at the P 0·05 level.

The hot, dry period of April to June was shortened experimentally by irrigating areas where cotton roots had been left in the ground instead of being removed in order to eliminate a source of infection. The number of ratoon plants which developed with the onset of the main July rains was substantially increased. A corresponding decrease in the number of ratoon plants was observed in areas where the hot, dry period was lengthened by discontinuing irrigation three to four weeks earlier than usual.

In investigating the cause of regional leaf curl outbreaks, the 'house effect' was considered after reports that the disease appeared first in the vicinity of houses. In the western Gezira in 1940 investigation showed that a significant negative correlation existed between the percentage of infected plants in each cotton number (a standard unit cotton block of approximately 90 acres) and the distance of that number from the nearest house. Of four areas surrounding houses examined the following year, there was the same significant negative correlation for one of these houses.

From the records made at the Gezira Research Farm since 1931 of the date when leaf curl first appeared each season on the new cotton crop, it was found that the disease appeared progressively earlier each year and increased in severity after the introduction, in 1936, of an alternative host of the virus, *Malvaviscus arboreus*. This plant has since been eradicated from the Research Farm with a resultant decrease in leaf curl. Although from June to mid-September the growing of plants known to be hosts of the leaf curl virus is prohibited, it is difficult to prevent the cultivation of okra (*Hibiscus esculentus*) along the bank of the Blue Nile which forms the eastern boundary of the Gezira Scheme, and as a result these plants become heavily infected with the leaf curl virus and act as a potential source of infection for the new cotton crop.

The rainfall-disease correlation is of interest in that it permits a forecast of the probable severity of leaf curl infection to be made ten weeks before the crop is sown; it allows a check on the efficiency of existing control measures to be maintained; and it may explain the depressing effect of early rains on cotton yield. If the April–May rainfall is exceptionally heavy it is advisable to make an extra effort in removing cotton ratoons to prevent a subsequent leaf curl outbreak. The 'house effect' may be due to the shelter afforded to insect vectors, such as white fly [*Bemisia* spp.]. The selection and planting of Sakel types resistant to leaf curl

should eliminate the disease from the northern Gezira, as the planting of X1730 A [loc. cit.] has done in the south.

NEAL (D. C.). **Discovery of Phymatotrichum root [rot] in Louisiana.**—*Plant Dis. Reptr*, xxxi, 11, pp. 416–417, 1 map, 1947. [Mimeographed.]

On 12th August, 1947, Dr. M. B. Sturgis found that cotton plants in a field north of Bossier City, Louisiana, were infected by *Phymatotrichum omnivorum* [*R.A.M.*, xxvi, p. 488], this being the first record of root rot in the State. An extensive survey revealed the occurrence of the disease in one other locality, the damage being rather severe. In addition to cotton the fungus was also found attacking sweet potatoes at Dixie and carrots, beans [*Phaseolus vulgaris*], and turnips at Bossier City.

STOA (T. E.). **Dakota—A new Flax.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.*, ix, 2, p. 53, 1946. [Received January, 1948.]

The release is announced of Dakota, a new flax variety, originating from a cross between Renew [*R.A.M.*, xxiv, p. 504] and Bison [ibid., xxvi, p. 490] and highly resistant to wilt [*Fusarium lini*: loc. cit.] and to all local strains of rust [*Melampsora lini*: ibid., xxvi, p. 489]. It is less susceptible to pasmo [*Sphaerella linorum*: ibid., xxv, p. 204] than most rust-resistant varieties and has not, as yet, been seriously damaged by it. Dakota ripens about the same time as Bison, or slightly earlier, and has yielded satisfactorily over a wide range of conditions. It is a product of co-operative research between the United States Department of Agriculture and the [N. Dakota] State Experiment Stations within the flax-growing area. Seed is now available to growers, on request.

BATISTA (A. C.). **Ceratostomella fimbriata (E. & H.) Elliot sôbre Crotalaria juncea L. em Pernambuco.** [*Ceratostomella fimbriata* (E. & H.) Elliot on *Crotalaria juncea* L. in Pernambuco.]—*Bol. Agric., Pernambuco*, xiv, 3, pp. 243–245, 3 figs., 1947.

A brief description is given of the cultural and morphological characters of *Ceratostomella fimbriata*, the agent of a destructive vascular wilt of *Crotalaria juncea* in Pernambuco, Brazil [*R.A.M.*, xv, p. 155], this being the first record of the fungus in the State.

WAGER (V. A.). **Wilt disease of New Zealand Flax.**—*Emg S. Afr.*, xxii, 260, pp. 871–878, 4 figs., 1947.

During May, 1940, a few wilted plants were noticed in a 300-acre planting of New Zealand flax (*Phormium tenax*) made on flat coastal land at Umhlatuzi, Zululand, in 1936. There was no increase in the disease in 1941, which was a dry year, but in 1942 and 1943, when there were heavy rains and frequent floodings, 60 to 80 per cent. of the plants were dead or wilting and the industry was abandoned. The disease has never been observed on the first planting made in the country (in 1932), which was on hill-sides at Melmoth. The soil of the diseased fields was found to be very wet, even after a dry month, and the pH was 4·6 to 5. The roots of infected plants were dead, rotten, or discoloured, and the rhizomes yellow or brown. The leaves could be easily pulled away from the plant when still green, or in cases where the disease had progressed more slowly they turned yellow. Rotted lesions up to 3 in. in size were observed on the leaf bases in the early stages. The duration of wet weather determined whether the disease subsequently spread to all the fans of a plant.

In most cases cultures from infected plants yielded a *Fusarium* sp. [cf. *R.A.M.*, i, p. 295], which has been named *F. oxysporum* f. *phormii* [n.f.]. Inoculations into healthy fans obtained from Melmoth caused typical symptoms in one-quarter of

the plants after about one to six months, the same species being isolated from them. The experiments showed that although the fungus could produce wilt in sound plants under healthy conditions it was apparently not a virulent parasite. The pathogen seemed to flourish in wet soil, while its growth was almost entirely arrested during dry weather.

Marchionatto (J. B.). **Nota sobre tres especies de 'Septoria' parásitos de las plantas.** [Note on three species of *Septoria* parasitic on plants.]—*Rev. Invest. agric., B. Aires*, i, 3, pp. 233–236, 1 pl., 1947.

Septoria gaillardiae Ell. & Ev., a widespread pathogen of *Gaillardia pulchella* in parks and gardens of Buenos Aires and La Plata, was first observed by the author in December, 1924. It forms on the leaves solitary, later confluent, spherical lesions, 2 to 8 mm. in diameter, with a pale centre, chestnut-coloured periphery, and darker margin. The subepidermal, subglobose, pseudoparenchymatous, greyish pycnidia, 140 to 180 μ in diameter, are furnished with an ostiole measuring 20 to 25 μ in diameter and contain cylindrical, slightly curved, continuous or uni- to triseptate pycnospores with smooth, colourless protoplasm.

S. leucanthemi was detected on *Chrysanthemum leucanthemum* [cf. *R.A.M.*, xvii, p. 13] in a Buenos Aires botanical garden in May, 1944.

S. cercidis, a new record for Argentina, was determined on *Cercis siliquastrum* from San Isidro in March, 1944. The upper surfaces and margins of the leaves are largely covered by chestnut-coloured, polygonal lesions, 1 to 3 mm. in diameter, delimited by the veins or confluent. The amphigenous, subepidermal, globose, brown pycnidia, 100 to 120 μ in diameter, contain irregularly cylindrical, flexuous, curved, continuous or sparsely septate pycnospores, 40 to 50 by 3 to 3·5 μ, with granular, hyaline protoplasm. The fungus grows well on 1 per cent. potato dextrose agar, forming compact, greenish, later darkening colonies, on which the mostly triseptate pycnospores appear in a whitish or pink-tinged exudate and are more regular in shape than those produced in nature.

Buchwald (N. F.). **Tulipan-mosaiksyge ('breaking'), den aeldst kendte virussygdom hos planter.** [Tulip mosaic disease ('breaking'), the oldest known plant virus disease.]—*Naturhist. Tidende, 1946*, 10, pp. 69–73, 4 figs., 1946. [Received January, 1948.]

The available information on the symptomatology, etiology, and history of the tulip-breaking virus [*R.A.M.*, xxv, p. 114] is summarized. The disease symptoms were recorded in 1614 by Passaeus in his 'Hortus floridus'. In Denmark the red varieties, e.g., Bartigon, King of the Reds, and Miss Heller, are the most susceptible to the disease, but the mauve William Copland is also commonly affected. Certain varieties, such as Columbine, are invariably 'broken'; on the other hand, the only Darwins attacked by the virus are those of the Rembrandt group.

Le Beau (F. J.) & Reynolds (F. J.). **Treatment of Lily bulbs for black scale control.**—*Phytopathology*, xxxvii, 11, pp. 801–808, 1947.

Of a number of fungicides tested for Easter lily (*Lilium longiflorum*) black scale (*Colletotrichum lilii*) control in the laboratory at the Louisiana Agricultural Experiment Station [*R.A.M.*, xxvi, p. 339], only one, phenyl mercuric triethanol-ammonium lactate, known under the code and trade names of puratized N5X, puratized N5E, and puratized agricultural spray, effectively eliminated the pathogen from infected bulb scales without severe injury to the tissues. In two years' field trials (1944–5 and 1945–6) a 24-hour treatment of the bulbs in a 1 in 1,000 to 1 in 2,000 solution of the 10 per cent. preparation gave practical control of bulb-borne infection.

The eradicant action of puratized N5E was inhibited by the simultaneous application of arasan and other derivatives of thiocarbamic acid which confer protection against reinfection through the soil. Fungicides of the latter group should therefore be used after the eradicant treatment.

ROLAND (G.). **La lutte contre les viroses du Dahlia.** [The control of virus diseases of *Dahlia*.]—*Parasitica*, iii, 4, pp. 163–164, 1947.

Observations on dahlias in Belgium showed that a high percentage of the plants examined were affected by one or more of the following virus diseases [cf. *R.A.M.*, xxv, p. 303]: dahlia mosaic, tomato spotted wilt, and cucumber mosaic. It is suggested that control measures should be undertaken without delay by means of sanitary selection of both cuttings and tubers, directions for which are given.

SPRAGUE (R.). **Rhizoctonia solani on field crops in the west.**—Abs. in *Phytopathology*, xxxvii, 11, p. 846, 1947.

Rhizoctonia [*Corticium*] *solani* constituted nearly 4 per cent. of all the fungi isolated from the roots of Gramineae in the northern section of the western United States [*R.A.M.*, xxvi, p. 48]. Among its symptoms were seed, root, stem, and culm rots. Five physiologic races of the pathogen could be differentiated by the reaction to greenhouse inoculations in North Dakota and Washington, from 1940 to 1947, inclusive, of Kubanka wheat, Marion oats, blue grama [*Bouteloua oligostachya*], crested wheatgrass [*Agropyron cristatum*], Turghai proso millet [*Panicum miliaceum*], black amber sorghum, and Grimm lucerne grown at 50° to 70° F. Race 1 was virtually non-pathogenic. Race 2 was only weakly parasitic on lucerne and *P. miliaceum* but caused up to 90 per cent. loss in *B. oligostachya* and up to 16 per cent. in oats and wheat. The effects of race 3 were similar except for its pathogenicity to sorghum (50 per cent. loss) and lucerne (total failure of crop plant). The very wide-spread race 4 was responsible for severe seed and root rot in all the indicator plants. Race 5, present along the Oregon and Washington coast, also attacked all the test plants except lucerne, which was highly resistant; it caused a culm rot after emergence.

MEINERS (J. P.). **Comparative growth in culture of eleven physiologic races of Ustilago bullata.**—Abs. in *Phytopathology*, xxxvii, 11, pp. 844–845, 1947.

In experiments to determine the effect of various temperatures on the cultural characters of head smut of grasses (*Ustilago bullata*) [*R.A.M.*, xxiv, p. 268; xxv, p. 386], two monosporidial lines of opposite sex of each of 11 physiologic races were grown for four weeks in culture chambers at a uniform relative humidity of 81 per cent. and at constant temperatures of 5°, 10°, 15°, 20°, 25°, and 30° C. In general, temperature was found to exert a very powerful influence on the growth rate of the smut, individual races of which, moreover, varied in their response to this factor. The optimum range for most races extended from 20° to 25°, some thriving over a wider range than others. Colour and topography were also greatly influenced by changes in temperature, which equally affected lines of either sex from the same chlamydospore.

BERKELEY (G. H.). **A strain of the Alfalfa mosaic virus on Pepper in Ontario.**—*Phytopathology*, xxxvii, 11, pp. 781–789, 2 figs., 1947.

This is an expanded account of the author's studies on a strain of the lucerne mosaic virus on chilli in Ontario, a summary of which has already appeared [*R.A.M.*, xxvi, p. 214]. The author suggests that the strain be called *Marmor medicaginis* var. *capsici*.

Kipps (E. H.). **The calcium/manganese ratio in relation to the growth of Lucerne at Canberra, A.C.T.**—*J. Coun. sci. industr. Res. Aust.*, xx, 2, pp. 176–189, 2 graphs, 1947.

Experimental evidence is presented showing that the unsatisfactory growth of lucerne on savannah soil at Canberra (marked by a range of symptoms including pale green or yellow leaves, brown tips, withering of the leaf edges and tips, and spindly, stunted growth of the whole plant) is attributable to high exchangeable manganese in the soil in conjunction with inadequate available calcium. Satisfactory growth resulted from raising the base saturation of the soil and the pH value to over 6·7; this reduced manganese availability to a minimum. Further increases in yield ensued as the available calcium was increased. A correlation was established between the calcium/manganese ratio in the lucerne and the health and yield of the plants, healthy plants having a ratio of over 66:1.

Mostafa (M. A.). **Studies on fungal competition. I. Comparative studies on the competitive fungal parasitism between Stereum purpureum, Nectria cinnabarina, and Botrytis cinerea on Prunus domestica. II. The nature of the host as a factor in competitive fungal parasitism.**—*Bull. Fac. Sci. Fouad I Univ., Cairo*, 26, pp. 157–210, 11 graphs, 1947.

Two factors were studied in connexion with the problem of selective competitive parasitism in three fungi, *Stereum purpureum*, *Nectria cinnabarina*, and *Botrytis cinerea* on Victoria plum, namely, (1) the individual seasonal pathogenicities of the several organisms to the host, and (2) the effect of competition between pairs of fungi within the plant tissues. The pathogenicity of *S. purpureum* to plum has been investigated by Brooks et al. [*R.A.M.*, xi, p. 59], but the relevant literature does not record any comparable experiments with *N. cinnabarina* and *B. cinerea* on the same host.

In field inoculations, mostly performed at the Botany School, Cambridge, *S. purpureum* proved capable of initiating infection throughout the year, though the host was comparatively resistant from July to September; the maximum degree of pathogenicity was observed in March. Infection by the other two fungi was negligible from May to November and in both cases reached a climax in March. The resistance of the host tissues to fungal infiltration was found to be closely connected with 'gum barrier' formation [loc. cit.].

The interaction between pairs of the three fungal competitors on the host was found to fall into two phases, an initial stage of incipient spore germination and a secondary one when the mycelia of both protagonists are present in the tissues. The primary phase appeared to be without significance in relation to the parasitism of the fungi under observation, none of which exerted reciprocal inhibitory effects on germination or development. On the other hand, the associative presence of the mycelium of *N. cinnabarina* invariably resulted in a reduction of the pathogenicity of *S. purpureum* from May to November, with a corresponding suppression of the external symptoms of silver leaf. In the case of joint infection by *B. cinerea* and *S. purpureum*, the presence of the former may either enhance or reduce the pathogenicity of the latter, generally in accordance with seasonal variations in the host. Thus, a decrease in the pathogenicity and symptom severity of silver leaf under the influence of *B. cinerea* occurred in February and March and again from July to September, and an increase from April to June and October to January.

The simultaneous presence of *N. cinnabarina* and *B. cinerea* in a plum twig does not perceptibly modify the external symptoms induced by either alone, and their interaction is only apparent during the brief period from December to April when either of the two can infect the host. In the February inoculations the association of *N. cinnabarina* caused an increase in the pathogenicity of *B. cinerea*. Similarly, the pathogenicity of *N. cinnabarina* was intensified by the presence of *B. cinerea*,

in the January, March, and December tests; in those of April, however, the former organism lessened the injurious effects of the latter on the host. Thus, the relationship between *B. cinerea* and *N. cinnabarina* is of a similar nature to that subsisting between the former and *S. purpureum*.

Raby Castle red currant bushes were found to be susceptible to *N. cinnabarina* [ibid., ii, p. 319] throughout the year, but only slightly so to *S. purpureum* in April and December, and they were completely resistant to *B. cinerea* in April, June, and August, the last-named exerting the maximum degree of pathogenicity in the May inoculations. As in the case of plum, the interaction between the three species appears to be confined to the mycelial state. The presence of *B. cinerea* is usually either immaterial or favourable to the pathogenicity of *N. cinnabarina*, the former influence operating in the April, August, and October tests and the latter in those of February, May, June, and December. The interactions of *S. purpureum* and *N. cinnabarina* were variable, the relationship being indifferent in February and August, in April and December the former reduced the growth of the latter, while in May, June, and October, the pathogenicity of *N. cinnabarina* was actually increased by the presence of *S. purpureum*. It would appear that the stimulatory effect of the silver leaf fungus on *N. cinnabarina* operated only when the air temperature exceeds 10° C.

In general, the relations between *S. purpureum* and *B. cinerea* are mutually inhibitory: in the June and August inoculations the red currant proved to be completely resistant to both species, individually and in combination.

Morwood (R. B.). **Experiment on the control of bacterial spot of Plums.**—*Qd agric. J.*, lxv, 4, pp. 239–242, 1947.

In 1930 bacterial spot of plum (*Xanthomonas pruni*) occurred in the Stanthorpe district of Queensland [*R.A.M.*, xiv, p. 641; xxvi, p. 18]. The disease is limited to certain varieties, the following being attacked, in addition to those previously recorded, in decreasing order of susceptibility: Santa Rosa, Doris, Beauty, Burbank, and Shiro. Wilson and English plum appear to be free from infection.

In preliminary trials in 1935 copper sprays were found to control the disease, and this was confirmed in the 1936 tests with Bordeaux mixture. In 1937 the best results were obtained by using a three-spray schedule, which has since been adopted as the standard recommendation for infected trees. Bordeaux mixture (6–4–40) should be applied at bud movement and again seven days later, the third application (at 3–2–40) being given just prior to full blossom. The second spray may be omitted if the disease is not serious.

Wenzl (H.). **Untersuchungen über die Kräusel- (Sternflecken-) Krankheit von Prunus armeniaca und anderen Prunaceen.** [Investigations on the curl (star spot) disease of *Prunus armeniaca* and other Prunaceae.]—*Phytopath. Z.*, xiii, 6, pp. 588–623, 7 figs., 1 diag., 2 graphs, 1941. [Received December, 1947.]

The author's protracted studies on the curl (star spot) disease of apricots, *Prunus cerasifera*, and other Pruneae in Austria [*R.A.M.*, xviii, p. 323] lend no support to Christoff's view, based on observations of the identical condition in Bulgaria, that a virus is concerned in its etiology [ibid., xxii, p. 90]. It is a sequel to the drastic pruning commonly practised in nurseries and as such may be relegated to the category of physiogenic diseases.

Ark (P. A.). **Disinfecting power of propylene oxide and propylene chloride in relation to phytopathogenic bacteria and fungi.**—Abs. in *Phytopathology*, xxxvii, 11, p. 842, 1947.

Propylene oxide gas [*R.A.M.*, xxvi, p. 461] at a concentration of 0·3 c.c. per l. inactivated *Xanthomonas phaseoli*, *Pseudomonas medicaginis* var. *phaseolicola*,

Ascochyta pisi, and *Fusarium solani* f. *cucurbitae* in 45 minutes under vacuum at 25° C., while 0·5 c.c. was required to kill *Verticillium* sp. in the same period. Dosages of upwards of 0·5 c.c. per l. and an hour's exposure were necessary to destroy *Agrobacterium* [*Bacterium*] *tumefaciens* and *Corynebacterium michiganense*. All the organisms listed succumbed to a ten-minute exposure to 1 c.c. per l. At a strength of 0·4 c.c. per l. and upwards, propylene chloride destroyed the same pathogens after a minimum exposure of 12 hours. The germination of Club wheat seed was reduced by some 50 per cent. by six hours' treatment under vacuum with propylene chloride at a dosage of 1 c.c. per l., but no adverse effects resulted from a four-hour exposure to the same concentration.

Boughey (A. S.). **The effect of rainfall on plant disease distribution in the Anglo-Egyptian Sudan.**—*Mycol. Pap., Imp. mycol. Inst.*, 19, 13 pp., 14 graphs, 3 diags., 1 map, 1947.

In this paper the author presents the results obtained in a preliminary study of the effects of rainfall on the composition of the economic plant disease flora in the Anglo-Egyptian Sudan, based on an analysis of the plant disease records collected over a period of six years. To record the regional disease distribution the 15 provinces into which the country was originally divided were used as a basis, the climatic and agricultural conditions in each being fairly uniform. The annual rainfall for each province was estimated from the mean annual readings of the Meteorological Service from each of the principal disease-collecting centres. The behaviour of diseases caused by the pathogenic agents of six selected groups was investigated in detail. These groups (bacteria, viruses, rusts, smuts, powdery mildews, and Fungi Imperfecti) were selected because each appears to have its own characteristic method of dispersal in the Sudan. The bacteria concerned are spread by driving rain, the viruses by insect vectors, the rusts by wind-blown uredospores, the smuts by chlamydospores distributed during maturation or at threshing time, the powdery mildews by wind-blown conidia, and the Fungi Imperfecti by rain-splashed or wind-blown conidia. The data obtained from the provincial plant disease lists were arranged in two ways. Firstly, for the diseases in each group the ratio of the actual 'records' to the 'total potential records' for a province was expressed as a percentage. The correlation between these figures and the mean annual rainfall for each province was determined, thus defining the relationship between the amount of rainfall and the presence of plant disease. Secondly, the relative proportion of each of the six groups of parasites in each provincial flora was given by their percentage representation in that flora. These figures were also related to rainfall graphically, thus determining the effect of rainfall in varying the composition of the disease flora.

The results obtained demonstrated positive and significant correlations between rainfall and diseases caused by smuts, Fungi Imperfecti, and bacteria, and the total number of diseases. The proportion of Fungi Imperfecti in provincial disease floras was found to be positively, and that of powdery mildews negatively, significantly correlated with rainfall.

Lagercrantz (C.). **Photo-electric counting of individual microscopic plant and animal cells.**—*Nature, Lond.*, clxi, 4079, pp. 25–26, 2 figs., 1948.

A photo-electric apparatus for counting individual microscopic cells was constructed at the University of Uppsala, Sweden. It consists of a microscope with a specially designed dark-field system and an *RCA* 931–*A* multiplier phototube connected with an amplifier which operates a mechanical counter. One half of a binocular eyepiece is used for visual observation, while the other is connected to the phototube.

In order to calculate the scanned volume the width of the scanning area must be known, and the method of calculating this is given. The cells must be evenly distributed and the cell suspension free from foreign particles which will be recorded on the system. The method was successfully used for counting yeast cells and agreed rather well with the results obtained by the ordinary counting-chamber method.

Williams (T. I.). **A modified microbiological assay procedure.**—*Nature, Lond.*, clxi, 4079, p. 19, 1 fig., 1948.

The suitability of the plate and cylinder method for assaying growth substances was investigated. Plates of sterile agar containing glucose and mineral salts were sown with a strain of *Saccharomyces cerevisiae*, and cylinders filled with a 1 to 250,000 solution of pure biotin, with saline as a control, were placed on the surface of the agar. The fungal growth was most prolific (at 37° C.) around the cylinders containing biotin and it was possible to make a graph relating ring size to biotin concentration. Other solutions could be assayed by comparing them on the same plate with known dilutions of a standard biotin solution.

Dexter (R. W.). **Status of Eelgrass in the Annisquam tidal river and Menemsha saltwater pond in Massachusetts during the summer of 1947.**—*Plant Dis. Reptr*, xxxi, 11, pp. 448–449, 1947. [Mimeographed.]

During the summer of 1947 a further significant increase in the amount of eel-grass (*Zostera marina*) [*R.A.M.*, xxvi, p. 162] was reported from Goose Cove and Gloucester Harbour, Annisquam River, Massachusetts, and other scattered areas in the vicinity. The entire southern and eastern parts of Goose Cove which are not exposed at low tide and a margin stretching along the northern shore showed a solid stand of apparently healthy eel-grass. Occasional fragments of diseased leaves [? *Labyrinthula macrocystis*] were discovered. No noticeable recovery of eel-grass since the epidemic of 1931–2 was observed in the main channel of the Annisquam River.

About four acres of eel-grass were found in the Menemsha Pond, the percentage of the re-vegetated area being less than that of the smaller Goose Cove.

Musgrave (A. J.). **Mycological and entomological problems of the leather industry.** —*Ann. appl. Biol.*, xxxiv, 3, pp. 449–457, 1947.

In this paper, read at the meeting of the Association of Applied Biologists held in London on 21st March, 1947, the author briefly discusses, with 23 references to the relevant literature, the problems arising from the moulding of leather [cf. *R.A.M.*, xxv, p. 409; xxvii, p. 148] and its control by fungicides.

Wikén (T.) & Öblom (Karin). **Some observations on effects produced by different kinds of resistance glass upon growth of mycelium and formation of antibacterial substance in cultures of a strain of Penicillium chrysogenum Thom.**— Reprinted from *Ark. Bot.*, xxxiii A, 14, 16 pp., 4 graphs, 1947.

Further studies have been made on the effects of different kinds of resistance glass on mycelial growth and antibiotic activity against *Staphylococcus aureus* of synthetic nutrient solution cultures of a member of the *Penicillium chrysogenum* series [*R.A.M.*, xxv, p. 307]. The Swedish M glass again accelerated the growth of the mycelium, substantially increased the yield of dry matter, and impaired the capacity of the mould to inhibit the development of *S. aureus*, as compared with parallel cultures in quartz glass flasks. Small discrepancies in respect of mycelial growth rate were noted between the cultures grown in flasks of Jena glass, American Pyrex, and French Pyrex on the one hand, and in quartz glass on the other, but these were not accompanied by any appreciable differences in antibiotic activity, determined by the cylinder plate method.

Locquin (Mme) & Locquin (M.). **Les antibiotiques d'origine fongique. Revue bibliographique. I, II.** [Antibiotics of fungal origin. Bibliographical review I, II.]—*Rev. Mycologie* (N.S.), xii, 1, pp. 37–44; 2, pp. 83–96, 1947.

This bibliography, an instalment of which is to appear in each issue of the *Revue de Mycologie*, aims at providing a bird's-eye view of the progress of researches on antibiotics derived from fungi or acting upon them, though no mention is to be made of their clinical or therapeutic applications. The first part gives notes on methods of dosage and on a number of antibiotics followed by a bibliographical index under corresponding headings; in part two use is made of the decimal classification, the main sections for both the notes and bibliography being (1) general publications, (2) generalities, (3) research methods, isolation, and dosage, (4) antibiotics of fungal origin, (5) antibiotics of non-fungal origin but active against fungi, and (6) synthetic antibiotics.

Schmidt (E. L.). **Mycorrhizae and their relation to forest soils.**—*Soil Sci.*, lxiv, 6, pp. 459–468, 1947.

Following a brief introduction, the author discusses the present status of the problem of mycorrhiza in relation to forest soils under the headings of roots of controversy, the higher plant component, the fungal component, incidence of the association, and theories of symbiotic mechanism. A bibliography of 40 titles is appended.

Delgado Montoya (N.). **El enrollado de las hojas de la Papa, una enfermedad de origen viroso.** [Potato leaf roll, a disease of virus origin.]—*Rev. Fac. Agron. Medellín*, vii, 27, pp. 347–380, 1947.

The recent report by K. Silberschmidt (*Acta trop.*, iii, pp. 27–35, 1947) on the occurrence of potato leaf roll in the Sabana de Bogotá, Fusagasugá, Pasca, and bordering regions of Colombia prompted this summary of the salient facts concerning the host range, history, geographical distribution, terminology, economic importance, symptomatology, etiology, pathogenesis, and control of the disease. A seven-page bibliography is appended.

Esbo (H.). **Potatis virosernas utbredning i Sverige.** [The distribution of Potato viruses in Sweden.]—*Nord. JordbrForsk., 1946*, 3–4, pp. 101–109, 1946. [English summary.]

A tabulated survey is given of the distribution in Sweden of the leaf roll, virus Y, and crinkle (X+A) potato viruses [*R.A.M.*, xxvi, p. 207] based on the results of field inspections of seed potatoes carried out by the Swedish State Seed Testing Station from 1943 to 1945.

Leaf roll and virus Y predominate along the south coast, notably in the province of Halland, where the conditions are most conducive to aphid transmission. The mixed virus disease is widespread throughout the country, especially in the south and other districts where intensive cultivation of the crop is practised. Considering that a large part of Sweden is well suited to potato-growing, the prevalence of the X+A virus complex must be attributed in the first place to the importation of seed from infested areas, and in the second to the use of the highly susceptible Gloria variety.

Bald (J. G.). **The treatment of cut Potato setts with zinc oxide. I. Condition of the setts, growth, and yield.**—*J. Coun. sci. industr. Res. Aust.*, xx, 2, p. 206, 1947.

In this addendum to the first paper of this series [*R.A.M.*, xxvii, p. 37] the author adds a caption which should have appeared under fig. 3 on p. 102.

Bald (J. G.). **The treatment of cut Potato setts with zinc oxide. 2. Infection of stems and tubers with Rhizoctonia and scab.**—*J. Coun. sci. industr. Res. Aust.*, xx, 2, pp. 190–206, 3 graphs, 1947.

Continuing his investigations [see preceding abstract] the author in this paper analyses the effects of potato sett treatment with zinc oxide on the production of stem lesions, the incidence of runner hyphae of *Rhizoctonia* [*Corticium*] *solani* on the stems, and that of *Actinomyces scabies* and *C. solani* on the tubers. Two series of infection data were taken, one when the setts were rated five weeks after planting, and the other after the tubers were harvested, the former consisting of records of lesions and macroscopically visible runner hyphae on the stems, the latter of scab lesions and *C. solani* sclerotia on the tubers.

The stems from healthy setts were relatively free from infection by *C. solani*, whereas untreated infected setts bore many stems damaged by lesions. Some of the treatments with zinc oxide and an organic mercury (hortosan) [cf. ibid., xxiv, p. 373] dip reduced the incidence of lesions and runner hyphae on the underground stems. Treatment after cutting was on the whole more effective than before cutting. The zinc oxide dip increased the yield of clean, sound tubers on the average by 27 per cent. Zinc oxide dip and dust and mercury dip gave partial or effective control of scab. It was also apparent that where the incidence of *C. solani* was high, that of scab was generally low, and vice versa. Statistical analysis of the distribution of the two diseases on 175 tubers showed that where there were numerous scab lesions the sclerotia of *C. solani* were relatively few and small, and vice versa, and that this negative correlation was highly significant. This is considered good evidence for the existence of antagonism between *A. scabies* (or closely associated organisms) and the strains of *C. solani* that produced runner hyphae and sclerotia. Examination showed that when the runner hyphae reached the edge of a scab lesion, which was almost always of the pitted type, they rarely descended into it, but turned aside and skirted it. In many cases the hyphae did not even penetrate between adjacent scab lesions. Sometimes sinuous runner hyphae were noted near and in scab lesions; superficially they resembled exhausted hyphae found in culture. No sclerotia were observed in fully developed pitted lesions, even on tubers where there was a zonal distribution of scab and *C. solani*. Occasionally, the surface of a tuber bore lesions apparently resulting from the interaction of the two fungi. They resembled superficial or slightly raised scab lesions, and consisted of more or less rectangular spots or freckles arranged in a circle like the numbers on a clock. *C. solani* runner hyphae were often present along the radiating lighter-coloured areas, which appeared to be lesions due initially to scab but checked early in their development by the invasion and antagonistic action of *C. solani*. Occasionally they assumed a concentric or irregular shape, or merged into small zones of freckling that no longer had the appearance of a distinct lesion.

In conclusion, it is suggested that the setts carried a surface microflora that grew with the shoots and on to the developing tubers, forming a sheath round the underground parts. After digging, the tubers carried on their surfaces a microflora derived partly from the mother tuber and partly from the soil.

Brown (W.). **Experiments on the effect of chlorinated nitrobenzenes on the sprouting of Potato tubers.**—*Ann. appl. Biol.*, xxxiv, 3, pp. 422–429, 1 pl., 1947.

Experiments extending over six years have demonstrated that the addition of a small quantity of folosan dust [*R.A.M.*, xx, p. 146] (the active principle of which is pentachloronitrobenzene) to clamps of the potato varieties Epicure, Great Scot, King Edward (one year only), and Ninetyfold markedly reduced winter sprouting and protected the sprouts against *Rhizoctonia* [*Corticium*] *solani*. Applied at the rate of 3·5 oz. folosan to 16 stone for Epicure and 6·5 oz. to 18·5 stone for Great Scot, the dust was blown from a bellows through the pile of potatoes lightly

moistened with a watering-can, as the clamp was built up. Dusted tubers stored in clamps gave yields equal to those of chitted tubers. Folosan DB 905 (the active principle of which is a tetrachloronitrobenzene), applied to Epicure and Great Scot potatoes kept in a closed space, repressed sprouting to an even greater extent, and the possible use of this dust for conserving ware potatoes is suggested.

De Bruyn (Helena L. G.). **Wisselbouw van Aardappelrassen als bestrijdingsmiddel tegen schurft.** [Rotation of Potato varieties as a control measure against scab.]—*Tijdschr. PlZiekt.*, liii, 5, pp. 139–143, 4 figs., 1947. [English summary.]

From 1939 to 1944, inclusive, at the Phytopathological Institute, Wageningen, Holland, 12 sprouts of each of the potato varieties Bintje, Eigenheimer, Alpha, and Jubel were grown on separate plots in frames containing soil heavily infected by scab (*Actinomyces*) [including *A. scabies*: *R.A.M.*, xxv, p. 78]. In 1945 the ground was left fallow, and in 1946 six sprouts each of Bintje and Eigenheimer were planted in all the plots.

The incidence and type of scab were found to differ with the reactions of the varieties cultivated during the preceding period. Thus, Bintje following the same variety was very severely infected, with only one sound tuber out of 44, the shallow type of pustule prevailing. About 20 of the 50 Bintje tubers following Eigenheimer were healthy but the infection (mainly shallow) was milder than in the two preceding plots. Of 34 Bintje tubers following Jubel, eight were healthy, while the pustules on the remainder were mostly minute and deep.

Of 49 Eigenheimer tubers succeeding Bintje, four were healthy, the rest being covered with mostly deep pustules, many still in the incipient stage. In the Eigenheimer plot following the same variety, 25 out of 56 tubers were sound, while the rest bore a large number of very deep pustules. Six out of 54 Eigenheimer tubers in the plot following Alpha were healthy, the remainder showing mostly small, deep pustules. Of 41 Eigenheimers following Jubel, 11 were healthy and the rest bore only a few small deep pustules.

These results appear to offer a promise of success through a judicious rotation of varieties, such as the resistant Jubel, which in these trials left the smallest residue of infective material in the soil for the succeeding crop. They further corroborate the observations of several authors that different types of scab on the same tuber are caused by distinct races of *Actinomyces*, to which different potato varieties react divergently and that the pathogenicity of the scab organisms is enhanced by development on the living host [cf. ibid., xviii, p. 412; xix, p. 41; xxiv, p. 113; xxvi, p. 508].

In view of the present incomplete knowledge of the taxonomy of the Actinomycetes, the author refrains from any distinction between 'races' and 'varieties' of *Actinomyces*, the former term being exclusively used in this paper.

Callbeck (L. C.). **A progress report on studies of the effects of varying the proportion of lime in Bordeaux mixture for Potato spraying.**—*Amer. Potato J.*, xxiv, 11, pp. 377–381, 1947.

In an experiment carried out in 1943 at the Dominion Laboratory of Plant Pathology, Charlottetown, Prince Edward Island, Canada, Green Mountain potatoes were sprayed against late blight (*Phytophthora infestans*) with Bordeaux mixture 4–2–40, 4–3–40, and 4–4–40, copper hydro 40, coppesan, and perenox. Seven sprays in all were given between 20th July and 10th September, inclusive. During the period 18th August to 9th September, inclusive, the increase in the percentage of infected leaflets for the different treatments was, respectively, 2·8, 3·5, 3·7, 3·4, 3·3, and 4·6, and for the unsprayed 83. In 1944 Bordeaux mixture 4–1–40 was included in the trials and, judged on the amount of tuber rot, gave the best control, with a loss of total yield of only 0·5 per cent., as against 4·5 for Bordeaux mixture 4–2–40,

9 for 4–3–40, 12·7 for 4–4–40, 5·3 for perenox, and 23·8 for the unsprayed. In 1945 a more rigorous test was devised. Unsprayed plots were alternated with sprayed in each block of replicates. At the conclusion of the experiment (27th September) the number of lesions per 10 plants was, Bordeaux mixture 4–1–40, 0; 4–2–40, 2; 4–3–40, 2·5; 4–4–40, 10; perenox, 10; copper A, 13·5; dithane, 62; zerlate, 92; untreated, 854. The 4–1–40 and 4–2–40 Bordeaux plots averaged 30 bush. per acre of graded tubers more than the 4–3–40 and 4–4–40 plots. In 1946, after the plots had been sprayed with a spore suspension in order to build up an epiphytotic, the percentage losses in tuber weight for the four Bordeaux mixtures in order of increasing lime content were 0·3, 0·6, 0·6, and 1·1, compared with 16 for the unsprayed.

Snieszko (S. F.), Carpenter (J. B.), Lowe (E. P.), & Jakob (J. G.). **Improved methods for the cultivation and storage of Phytophthora infestans.**—*Phytopathology*, xxxvii, 9, pp. 635–649, 2 figs., 1947.

Experiments conducted at Camp Detrick, Frederick, Maryland, from January, 1944, to August, 1945, were aimed at the development of simple and reliable methods for the production of sporangia and mycelium by the agent of potato and tomato blight (*Phytophthora infestans*) and the prolongation of its viability in storage [cf. *R.A.M.*, xiii, p. 120; xxv, p. 137]. On well-aerated, porous, sterile media consisting of 1 part cereal grains (wheat and malted rye), 1 to 2 parts groundnut hulls, and 2 to 8 parts distilled water (pH 5·5 to 6), the fungus formed sporangia in abundance at 20° C. The substitution of navy beans [*Phaseolus vulgaris*] for cereal grains induced more profuse mycelial growth but sporangia were fewer. If the media were autoclaved for longer than 30 minutes sporangial production was reduced. Liquid media proved suitable for mycelial production only. Under optimal conditions, the maximum yield of sporangia was obtained after eight to ten days' incubation. Harvesting was effected by washing the sporangia off the medium with sterile, distilled water. These suspensions were used as inocula. The sporangia were generally short-lived, five days in distilled water and 10 days in 10 to 20 per cent. dextrose at 0° to 2° only; on solid media viability dropped from 90 per cent. after 10 days to 17 and 22 (at 20° and 6° to 12°, respectively), after 50 days.

The mycelium of *P. infestans* grew best in shallow (10 to 15 mm.) cultures of malted wheat or rye grain extracts, especially rye, with added dextrose. Substantial increases in production were secured by the addition of small quantities of agar to liquid media. Artificial aeration of deep cultures in liquid media was essential for the satisfactory development of the pathogen, but shallow cultures were best left undisturbed. The mycelium remained viable for at least 146 days in water or wet soil at 5° to 10°.

Wallace (T.) & Hewitt (E. J.). **Effects of calcium deficiency on Potato setts in acid soils.**—*Nature, Lond.*, clxi, 4079, p. 28, 1 fig., 1948.

During the war potatoes planted as a first crop in very acid soils (pH 4) often failed to grow, and those plants which survived usually showed typical symptoms of calcium deficiency in the haulms. The tubers remained firm but failed to form shoots.

In the course of experiments conducted at Long Ashton Research Station, sprouted Majestic potato setts were grown in sand with and without calcium; pH values of 3·5 and 5·5 were used. Plants to which no calcium was added failed completely. The sprouts had broken down behind the growing points and died off, but the roots appeared normal and the tubers remained firm. After having been thoroughly washed the affected tubers sprouted normally in boxes without sand or soil. All cultures which received calcium developed normal shoots.

It is concluded that the condition on acid soils is due to calcium deficiency.

Motte (J.). **Mycopathologie d'Oryza sativa L. II. L'helminthosporiose.** [Mycopathology of *Oryza sativa*. II. Helminthosporiosis.]—*Rev. Mycologie*, N.S., *Suppl. colon.*, xii, 1, pp. 4–25, 3 figs., 1947.

This account, based chiefly on the literature, to which there are 100 references, of *Ophiobolus miyabeanus* on rice [*R.A.M.*, xxvi, p. 509], includes a description of the pathogen and its conidial stage, *Helminthosporium oryzae* [ibid., xxv, p. 96], its morphology, taxonomy, physiologic races [ibid., xvi, p. 632], and common names. The relative influence of external conditions and the action of the disease on various parts of the plant are discussed; preventive measures, treatment of the disease, the resistant varieties, the nature of resistance, and host range are briefly reviewed.

Midgley (A. R.) & Dunklee (D. E.). **Boron for Vermont soils and crops.**—*Bull. Vt agric. Exp. Sta.*, 539, 20 pp., 6 figs., 1 graph, 1947.

After pointing out that at least 31 of the United States and six provinces in Canada have reported boron deficiencies in over 40 different crops [*R.A.M.*, xxv, p. 80], the authors briefly review the general importance of this element in agriculture, the factors affecting its availability to plants, methods of study of boron deficiency symptoms, the symptoms displayed by 16 crop plants, methods and rates of boron application, the boron content of Vermont soils, and the question of fixation.

Chemical analyses of 39 different soil types showed that only 22, or 56 per cent., had sufficient boron for most Vermont crops. Even on these soils, however, extra boron is required for some plants, including lucerne and apple. On soils known to be deficient a broadcast application should be made to correct the trouble, and then fertilizers to which boron compounds have been added should be used to maintain the boron level. It is recommended that all fertilizers sold in Vermont should include boron, potato and (perhaps) garden fertilizers containing not over 5 lb. borax per ton, and others 10 lb. For lucerne, 40 to 50 lb. borax [per acre] should be broadcast on all Vermont soils before planting. In most cases this will be sufficient for at least four years. For red and alsike clovers 30 to 35 lb. is adequate. For white clover and [its variety] Ladino boron should not exceed 25 to 30 lb. per acre when applied to the surface soil of established pastures; higher rates may be used if the boron is broadcast and worked into the soil before planting. For garden vegetables only 30 to 35 lb. borax per acre should be used, as some boron-sensitive plants may also be grown in the garden. Apple trees [ibid., xxvi, p. 158] should be given ½ to 1 lb. borax per tree, according to age. This should suffice for two or three years. If the trees produce corky apples, the amount should be increased. Potatoes have shown response to applications of 5 lb. borax per acre if drilled in the row with fertilizer. If broadcast and worked into the soil, 30 to 40 lb. are suggested.

Nel (G. C.). **Genera et species fungorum ex Herb. P. A. van der Byl, Stellenbosch.** [Genera and species of fungi from the herbarium of P. A. van der Byl, Stellenbosch.]—*Ann. Univ. Stellenbosch*, Ser. A, xx, 2, 110 pp., 1942. [Received October, 1947.]

This is a list of the fungi represented in the herbarium of the late Professor P. A. van der Byl, now in the possession of the University of Stellenbosch.

Bond (T. E. T.). **Notes on Ceylon fungi and plant diseases. Part I. (1–15).**—*Ceylon J. Sci.*, Sect. A, xii, 4, pp. 171–193, 12 figs., 1947.

The first instalment of this series of notes on records of new occurrences and other items of interest in the Ceylon mycoflora consists exclusively of Fungi Imperfecti, including the following: *Alternaria brassicae* on Chinese cabbage, Chinese mustard (*Brassica juncea*), and cabbage (secondary on the last-named to *A. oleracea*

[*A. brassicicola*: *R.A.M.*, xxv, p. 580; xxvi, p. 405], which also attacks kohl-rabi); *Ascochyta abelmoschi* on *Hibiscus esculentus* and *H. rosa-sinensis* [ibid., xxii, p. 340]; *A. cyphomandrae* on *Cyphomandra betacea*, described by Petch in *Ann. R. bot. Gdns Peradeniya*, vii, p. 313, 1922; *A. oleracea* var. *tumida* n. var. on cabbage, the variety differing from the type in its tumid, wider spores (up to 5 μ), with a slight median constriction; *Cercospora brassicicola* on Chinese cabbage and *B. juncea*, the specimens herein described agreeing in all respects with E. W. Mason's interpretation of the species [*R.A.M.*, xv, p. 467]; *Cercosporella brassicae*, causing white spot of turnips [loc. cit. and ibid., xxii, p. 461]; and *Septoria violae* [cf. ibid., xv, p. 283] on *Viola betonicifolia*, a common weed of up-country tea estates.

Cladochaete coronata n. sp., collected on fallen leaves of *Grevillea robusta*, has globose, umber or sepia pycnidia, about 120 μ in diameter, the ostiole, 30 μ in diameter, surrounded by a crown or tuft of stiff, unbranched, smooth, thick-walled setae, somewhat swollen at the base, blunt or truncate at the apex, 60 (or occasionally considerably longer) by 4 to 5 μ; paler hyphae, about 3 μ wide; and green to olivaceous, smooth, non-septate, bi- to triguttulate, oblong-ellipsoidal, obtuse-ended spores, 5·5 to 7 by 2·5 to 4 (mean of 25, 6·3$\pm$0·09 by 3·1$\pm$0·07) μ.

Heterosporium tropaeoli n. sp. produces on *Tropaeolum majus* leaves irregular or subcircular, brownish to purple spots, 1 cm. in diameter, sometimes confluent, the centres later shrivelling and the surrounding tissues forming a broad, yellow margin. Sporulation occurs on the lower surface only, the conidiophores emerging from the stomata singly or in small groups; they are thick-walled, somewhat rigid, nodulose, and undulate, scarcely branched except rarely near the base, up to 175 by 8 μ. The conidia measure 30 to 40 by 16 to 22 μ and are almost invariably triseptate, the cells swollen and constricted at the septa, the median cell barrel-shaped and the end ones hemispherical, the colour being a clear brown within the range of Dade's *isabellinus* [ibid., xxiii, p. 150].

The *Phyllosticta* described by Gadd as responsible for leaf fall of *G. robusta* [ibid., xvii, p. 205] is named *P. grevilleae* Gadd n. sp., with a Latin translation of his diagnosis (slightly extended).

Moreau (C.). **Sur quelques Parodiella africains.** [Concerning some African species of *Parodiella*.]—*Rev. Mycologie*, N.S., *Suppl. colon.*, xii, 1, pp. 26–33, 4 figs., 1 graph, 1947.

A description is given of the systematic position and morphology of two *Parodiella* spp. on their African hosts. *P. perisporioides* [*R.A.M.*, xvi, p. 279] has been found on the leaves of *Crotalaria retusa* in Madagascar and on *C. naragutensis* in the Cameroons, *P. paraguayensis* on a *Crotalaria* sp., and *P. paraguayensis* f. *macrospora* on *Sphenostylis schweinfurthii*, both in the Cameroons.

Tubbs (F. R.). **The control of blister blight of Tea (Exobasidium vexans Massee).**—*Tea Quart.*, xix, 2, pp. 34–41, 1947.

In this paper, the basis of a lecture given to the Low-Country Products Association, Colombo, in July, 1947, the author discusses the weaknesses inherent in attempts to rely on any single method for the control of tea blister blight (*Exobasidium vexans*) [*R.A.M.*, v, p. 703; vi, p. 582; xxvi, p. 568], the spread of the disease in relation to the life-history of the causal organism, the use of natural controlling factors (such as high temperature, dry air, maturity of tissues, and light), and the advantages of spraying and dusting. There appears to be no evidence at present to indicate that any severe control measures are as yet called for at elevations under 1,500 ft. Above these elevations the following control measures are recommended, with the proviso that localities above a seasonal mist line will require more radical measures than those below which enjoy a sunnier climate. In seasons favourable to infection the pruning should be even lighter than that

previously suggested [ibid., xxvi, p. 515]. Fringe pruning should be practised at elevations over 3,000 ft., merging into lung pruning at lower ones. Fields pruned for wet weather recovery should be carefully selected as regards aspect, lie of the land, and permanent shade. Early tipping is recommended, but not at a lower height than normal. Side branches (fringe) or lungs should not be shortened at low elevations until there is a good canopy of new leaf, and even then not below tipping level. There should be more frequent lopping of medium shade to take full advantage of all dry periods, thinning of high shade where necessary, and greater use of green manures. Spraying recommendations are given [ibid., xxvi, p. 569]. Excessive applications of fungicides should be avoided. The selection of clones for resistance is also advised.

Tubbs (F. R.). **An interim report on blister blight situation for the information of agency houses. (Reprinted for information.)**—*Tea Quart.*, xix, 2, pp. 41–43, 1947.

In this paper, an amplification of a short communiqué previously issued to the press, the author briefly recapitulates and extends advice already given on the subject of the modification of cultural practices to meet the present situation in Ceylon as regards tea blister blight [*Exobasidium vexans*: see preceding and next abstracts].

Tubbs (F. R.). **Notes on blister blight.**—*Tea Quart.*, xix, 2, pp. 50–56, 1947.

The formation of red blisters on tea bushes affected by blister blight [*Exobasidium vexans*: see preceding abstracts] depends upon the particular tea bush and does not indicate a more virulent strain of the fungus. Bushes having a tendency to produce pigment, especially as a wound reaction, form red blisters.

The unusual presence of blisters on apparently mature leaves results from infection somewhat late in the development of a leaf, in wet or cloudy weather. The marked varietal differences in resistance noted in the field emphasize the importance of the selection by growers of resistant clones. Where tree-felling is undertaken to increase the proportion of bush green manures and of those types of tree shade whose density is easily controllable by lopping, diseased roots must be excavated and destroyed. To prevent invasion of stumps by air-borne spores of root disease fungi the tree should be felled just below the collar, the exposed surface covered with soil, and the stump left to be destroyed by soil saprophytes. Importance is attached to the early removal of all soft 'banji' growth back to one leaf regularly during the initial five or six plucking rounds in fields recovering after cutting across just above the tipping level.

No evidence of the presence of other hosts of *E. vexans* in Ceylon has been obtained. As the fungus has demonstrated its ability to persist on tea locally throughout the year, the question is not of practical importance.

The view that a more 'vigorous' or more 'healthy' tea bush is more resistant than others to fungal disease is regarded as ill-founded. In bearing tea, high cropping or 'vigour' is accompanied by increase in the proportion of young shoots and 'third leaves', and therefore by an increase in the susceptible area of the bush. Heavy flushing is likely to be accompanied by increased blister blight when conditions favour attack. This has occurred on the clonal plots at St. Coombs and the manurial plots at Passara.

Extensive observations in fields pruned late in 1946 and early in 1947 led to the following preliminary conclusions which should be used as the basis of the 1947–8 dry weather recovery programme at elevations over 1,500 ft. (in districts receiving both monsoons). Where the period between pruning and budbreak is approximately six weeks pruning should be completed before the end of January. Where budbreak takes a longer or shorter period, pruning should be completed proportionately

before or after the end of January, respectively. The earliest advisable date for pruning in Dimbula (considering blister blight only) is about 1st December, and at higher altitudes earlier. If the annual programme cannot be completed between 1st December and end of January, the extra risks involved are least if pruning is started before 1st December and greatest when it is protracted after the end of January. If pruning must be done during February, it should be done very lightly. Pruning carried out before the end of January may be of normal severity provided (1) spread is maintained by leaving all the fringe branches intact to the future tipping level, (2) numerous, closely spaced points of last-cycle wood are left, and (3) cutting down into old wood is avoided as much as possible.

One bush which appears to show very high resistance has so far been found in Ceylon. Growers are asked to supply the Tea Research Institute with propagating material from pruned bushes showing high resistance. The results from manurial plots indicate that manuring is unlikely to prove of importance in reducing the disease.

Tubbs (F. R.). **A leaf disease of Tea new to Ceylon.**—*Tea Quart.*, xix, 2, pp. 43–45, 1947.

This paper, the text of a lecture delivered to the Pussellawa Planters' Association on 11th November, 1946, describing briefly the symptoms, distribution, and control of blister blight [*Exobasidium vexans*] of tea in Ceylon, is reprinted in order to illustrate by comparison with the accompanying articles on the subject [see preceding and next abstracts] the refinement in the application of agricultural control measures that has resulted from experience. The recommendations that have now been modified are marked with an asterisk.

Van der Kiste (W. R.). **Blister blight. Some financial aspects of its control.**—*Tea Quart.*, xix, 2, pp. 48–49, 1947.

Since tea blister blight (*Exobasidium vexans*) [see preceding abstracts] first appeared in Ceylon, local growers have (rightly, it is considered) concentrated on control rather than eradication. The author considers the financial aspects of the methods recommended, viz., short plucking rounds and pruning at the beginning of the dry-weather season. To make short rounds profitable a good flush of growth is necessary and for this the requirements are (*a*) manure in increased doses, and (*b*) good pruning to promote a rapid flow of sap from the roots to the flushing points. Pruning only at certain times of the year entails reducing the area to be pruned or increasing the labour force employed, or both. Reduction of the area means longer pruning cycles, and for this to be economic the requirements are again more manure and clean, hard pruning. As harder pruning retards the rate of return to plucking it must be carried out early in the pruning season, the relatively lighter pruning being effected towards the end.

It is concluded that blister blight is controllable, but will continue to reduce crops, while control will necessarily increase production costs. The amount of crop lost will be inversely proportional to the increased expenditure, and the economic mean, which will be different on every estate, must be determined by each individual planter.

Hopkins (J. C. F.) & Bates (G. R.). **Field spraying of Tobacco. Bacterial wilt of Tobacco and other plants.**—*Rhod. agric. J.*, xliv, 5, pp. 473–475, 1 pl., 1947.

Up to 1945 the methods of disease control used by most growers in Southern Rhodesia did not give altogether satisfactory control of tobacco diseases, but in that year a scheme of co-operative spraying experiments with a commercial firm, Messrs. Pest Control (C.A.) Ltd., using up-to-date high-pressure power equipment, was adopted by the Agricultural Branch. As a result, distinct indications of the

control of *Alternaria longipes* [*R.A.M.*, xx, p. 449; xxv, p. 529] and frog eye [*Cercospora nicotianae*: ibid., xx, p. 180] were observed. Complete control of angular leaf spot [*Pseudomonas angulata*: loc. cit.] was also obtained. Further work on this scheme is in progress.

Algera (L.), Thung (T. H.), & Van der Want (J. P. H.). **Over het zuiveren van plantviren.** [On the purification of plant viruses.]—*Tijdschr. PlZiekt.*, liii, 5, pp. 133–139, 1947. [English summary.]

Two categories of plant viruses are included in this discussion of purification methods, viz., those readily purifiable, such as tobacco mosaic, tomato bushy stunt, and turnip yellow mosaic [*R.A.M.*, xxv, p. 284], and those requiring a more complicated technique, e.g., potato virus X. Using the method devised by Bawden and Pirie for the purification of tomato bushy stunt virus [ibid., xxii, p. 458], the authors effected partial purification of the virus causing 'rattle' disease ['ratelziekte'] of tobacco in Holland [ibid., xxv, p. 83]. The brown, amorphous product obtained by salting out with ammonium sulphate (following the removal of the bulk of the normal cell constituents by ten minutes' exposure of the diseased plants to a temperature of 60° C. and centrifuging off the coagulum) retained its infectivity during three months' storage at 12°.

Johnson (J.). **Virus attenuation and the separation of strains by specific hosts.**—*Phytopathology*, xxxvii, 11, pp. 822–837, 5 figs., 1947.

The true nature of attenuation, in connexion with plant and animal viruses, has not been conclusively determined [*R.A.M.*, vi, p. 43]. Similarly, the natural origin of apparently new or highly virulent strains of viruses from normal parents is still obscure. The tobacco mosaic virus offers exceptional opportunities for the study of such phenomena. By the use of appropriate methods and safeguards pure-line strains may be isolated which for all practical purposes arise from single virus particles and, on the whole, remain remarkably constant. Reliable information on the essence of virus attenuation and mutation can be gained only through the investigation of pure-line strains.

Naturally infected sea holly (*Eryngium aquaticum*) plants regularly yielded an attenuated strain of the tobacco mosaic virus. Laboratory plants of the former host inoculated with an ordinary field culture of severe tobacco mosaic virus yielded only an attenuated strain from the uninoculated or new leaves, though the severe virus infected the inoculated leaves as well. When sea holly plants were inoculated with pure-line strains of severe and attenuated virus separately, the former remained localized in the inoculated foliage while the latter became systemic. The attenuation of the tobacco mosaic virus, therefore, is due to the capacity of sea holly for the separation of an attenuated from a severe strain when both exist in combination. Similarly, the Marglobe tomato was shown to be capable of performing the separation in reverse, i.e., of isolating a severe from an attenuated strain of the tobacco mosaic virus in a mixture. Selective properties of this kind would no doubt afford opportunities for the development of strains of enhanced virulence in nature as opposed to laboratory isolations. The pathogenicity of the separated severe strain is intensified, moreover, by the loss of the immunizing influence of the attenuated strains. However, the latter produced well-defined, local necrotic lesions on certain species and varieties of *Nicotiana*, e.g., a foreign tobacco known as Daruma, *N. sylvestris*, and *N. longiflora*, whereas they responded to the severe strain only by faint chlorotic areas on the foliage or else by systemic infection.

It was found that single-lesion, pure-line strains of the tobacco mosaic virus, normally remaining constant, could be induced to mutate at a relatively high rate by allowing multiplication to occur at temperatures of 35° to 37° C. In this way both attenuated and new strains have been isolated. The production of new strains

from pure-line strains by heat treatment of the multiplying virus opens up new possibilities for basic research on virus mutation.

Scaramuzzi (G.). **Relazione preliminare sulle malattie ed alterazioni del Tabacco riscontrate in Italia nel 1947.** [A preliminary account of the diseases and abnormalities of Tobacco observed in Italy in 1947.]—Ex Studi e Ricerche sul Tabacco dell' Istituto e Orto botanico dell' Università di Pavia, pp. 31–46, 1947 (reprinted from *Il Tabacco*, 1947).

During 1947 tobacco in northern Italy was almost everywhere affected by ordinary mosaic [tobacco mosaic virus: *R.A.M.*, xvii, p. 773], Burley being widely attacked, while Kentucky showed moderate resistance. Infection in the different fields ranged from 10 to 90 per cent., and loss was increased by the fact that the outbreaks occurred at an early stage of growth. Ring spot [virus: ibid., xvi, pp. 115, 566] was found sporadically but was not serious, Burley being chiefly affected, Kentucky less so. Speck spot ('picchiettatura'), a condition characterized by white or yellowish-brown leaf spotting and often associated with various forms of virus attack, also appears to be of virus origin. Kentucky was rather severely affected. The disease has been attributed hitherto to *Bacillus* [*Pseudomonas*] *maculicola* [ibid., xiv, p. 658]. It does not appear to be very injurious, but the dry spots remain conspicuous even after curing, and may reduce the market value of the leaf.

In central Italy, where most of the tobacco grown is Bright Italia and Kentucky, virus diseases, especially mosaic, were prevalent, but were less serious than in northern Italy. Ring spot was present but not serious. Speck spot was found only on Bright Italia. Veinbanding was occasionally observed on Kentucky, but it also affected Burley, both varieties being particularly susceptible when grown near potatoes. The disease does not seem to be serious in Italy. Potassium deficiency symptoms were prevalent, especially on Bright Italia. Sand drown, due to magnesium deficiency [ibid., viii, p. 473 *et passim*], was less common. Boron deficiency was noted occasionally. In the Perugia–Magione region, Bright Italia showed a condition tentatively attributed to zinc deficiency. Appreciable damage was caused by mildew (*Erysiphe cichoracearum*), which has not been reported on tobacco in Italy for 40 years; the ascigerous stage was observed on leaves from plants growing near Pescara. *Alternaria* disease was occasionally found on Kentucky. Bright Italia was affected by leaf spots provisionally attributed to *Cercospora nicotianae* and *Ascochyta nicotianae* [ibid., xxv, p. 292] and occasionally by albinism (white chlorotic areas on the leaves), the cause of which has not yet been determined.

In southern Italy (vicinity of Salento), marked attacks of mildew were observed, oriental varieties being much more susceptible than North American. Mosaic, ring spot, and speck spot were noted. Frenching [ibid., xxv, p. 334] was present on oriental varieties, and 'green spot', of unknown origin, was widely prevalent.

Matsumoto (T.). **Dwarf-disease of Tobacco due to Hemitarsonemus latus.**—*Trans. nat. Hist. Soc. Taiwan* (formerly *Trans. nat. Hist. Soc. Formosa*), xxxiv, 251, pp. 259–263, 1944. [Received December, 1947.]

Further investigations on the dwarf disease of tobacco in Formosa, characterized by atrophy, leaf roll, and glossiness of the lower leaf surfaces [*R.A.M.*, xviii, p. 479], have shown it to be caused by a mite, *Hemitarsonemus latus*. Although dwarf disease and leaf curl virus are frequently associated on the same plant, there is no other connexion between them, nor does the mite appear to act as a vector of the virus.

Matsumoto (T.). **Some necrotic virus diseases of Tobacco.**—*Trans. nat. Hist. Soc. Formosa*, xxxi, 217–218, pp. 433–442, 4 figs., 1941. [Japanese, with English summary. Received December, 1947.]

Three virus diseases of tobacco in Formosa, supplementary to those already

described [*R.A.M.*, xix, p. 620; xxvi, p. 422], are here recorded under the designations of types 1, 2, and 3.

In type 1 necrotic spots of variable size and shape develop on the leaves, usually accompanied at first by a faint mottling and later by mosaic patterns, mostly on the young expanding foliage developing from the lateral buds after topping. In plants inoculated under glass the yellow or necrotic spots appear within a week, after which the infection spreads to the upper young leaves, usually proceeding from the margin inwards.

The most prominent symptom of type 2 is necrosis of the ground tissue along the midrib and the veins arising therefrom. At a later stage lesions are formed on the stem. Greenhouse inoculations usually result, within a fortnight, in the development of primary, irregular, necrotic lesions, followed by necrosis of the upper young leaves, mostly in the region of the veins: oak-leaf patterns of yellow tissue with necrotic edges were occasionally observed. Yellowish patterns subsequently develop on the upper expanding leaves, which mostly show some distortion due to the arrested growth of the veins in the chlorotic area; eventually the yellow tones shade into brown and the characteristic necrosis appears.

The outstanding feature of type 3 in the field is the presence on the lower leaves of necrotic lines, radiating in zigzag form and either irregularly encircled or disposed in a zigzag line along the veins. Leaves inoculated in the greenhouse usually develop irregular spots in a few days and then wither immediately, as also do some of the upper young ones, except at the top. The new foliage produced later is free from symptoms, though the zigzag lesions may still be formed on some of the older leaves.

Judging by the results of serological and cross-immunity tests and some physical reactions, e.g., to heat, desiccation, and filtration, type 1 appears to be very closely allied to the tobacco mosaic virus, of which it is regarded merely as a variant. The same applies to type 2, which appears to be closely related to Norval's derivative, N2, of J 14, Jensen's variant of tobacco mosaic [ibid., xviii, p. 614]. Type 3, on the other hand, is thought to be definitely distinct from any of the foregoing viruses and may well be a form of the tobacco ring spot virus described by Fromme *et al.* [ibid., vi, p. 699].

Beale (Helen P.) & Lojkin (Mary E.). **A comparison of the infectivity of different preparations of Tobacco-mosaic virus with their ability to precipitate specific serum antibody.**—*Contr. Boyce Thompson Inst.*, xiv, 9, pp. 457–469, 1 graph, 1947.

Quantitative studies on the precipitin reaction of the tobacco mosaic virus antiserum system [*R.A.M.*, xxiv, p. 341] having shown that the infectivity of the oldest virus preparation used was less than that of more recently purified ones, a study [which is fully described] was undertaken to compare the ability of the various preparations to combine with serum precipitin on a quantitative basis, and to determine whether loss of infectivity was accompanied by any appreciable decrease in the amount of precipitate formed. From the results obtained it is concluded that virus preparations differing widely in infectivity may react similarly with specific antibody on a quantitative basis.

van der Laan (P. A.). **Antibiotische stoffen als fungicide tegen Cercospora nicotianae op Tabak.** [Antibiotic substances as fungicides against *Cercospora nicotianae* on Tobacco.]—*Tijdschr. PlZiekt.*, liii, 6, pp. 180–187, 1947. [English summary.]

Several fungal extracts containing antibiotics were tested at the Phytopathological Laboratory 'Willie Commelin Scholten', Baarn, Holland, for fungistatic activity against *Cercospora nicotianae*, the agent of tobacco frog eye in the tropics.

Actinomycin from *Actinomyces* spp., streptomycin from *A.* [*Streptomyces*] *griseus*, and viridin from *Trichoderma viride* [*R.A.M.*, xxvi, p. 23] exerted only a very feeble action on the pathogen; streptothricin from *A. lavendulae* [ibid., xxiv, p. 463] was slightly more effective; pure clavacin [produced by *Aspergillus clavatus*: ibid., xxiii, p. 495] was fungistatic at a dosage of 1 in 50,000 but caused burning of the leaves at 1 in 25,000. Gliotoxin from Brian's strain No. 211 of *T. viride* gave the most promising results, its highly fungistatic and fungicidal principles being unaccompanied by any deleterious effect on the foliage.

Sauer (H. F. G.). **A cigarrinha Agallia albidula Uhl. (Hom. Cicadel.) vetora de uma doença de virus do Tomateiro.** [The leafhopper *Agallia albidula* Uhl. (Hom. Cicadel.), vector of a Tomato virus disease.]—*Biológico*, xii, 6, pp. 176–178, 2 pl., 1946.

From 1942 onwards the prosecution of a campaign for the extermination of an insect pest of tomato in São Paulo was interrupted by the excessive incidence of virus diseases, notably 'vir cabeça' [tomato] (spotted wilt) [virus: *R.A.M.*, xxi, p. 354], which precluded the maintenance of an adequate number of experimental plantings. Diseased plants collected in the field in 1946 harboured an abundant population of *Agallia albidula*, which transmitted up to 66·6 per cent. virus infection to healthy plants under controlled conditions. Further investigations are in progress.

Kramer (M.). **A transmissão experimental e a identificação de uma doença de virus do Tomateiro.** [The experimental transmission and the identification of a Tomato virus disease.]—*Biológico*, xiii, 2, pp. 44–47, 1 pl., 1947.

A virus disease affecting tomatoes in São Paulo proved to be transmissible by grafting to its own host (Santa Cruz and Bonny Best varieties), White Burley tobacco, *Nicotiana glutinosa*, *Datura stramonium*, and *Petunia hybrida*, the plants in some of the tests contracting up to 100 per cent. infection. The symptoms are in some respects analogous to those induced by the potato yellow dwarf virus [*R.A.M.*, xvii, p. 411 *et passim*], but the Brazilian disease is believed to be caused by a specific entity: it also appears to be distinct from Sauer's tomato virus [see preceding abstract], being transmissible neither by *Agallia albidula* nor by Bennett's dodder method [ibid., xxiv, p. 136].

Vasudeva (R. S.) & Sam Raj (J.). **A latent virus in Tomato.**—*Curr. Sci.*, xvi, 11, pp. 348–350, 2 figs., 1947.

Sutton's Early Market tomato plants inoculated in an insect-proof house with the juice of tomato plants affected by 'smalling disease' developed a faint, transient mottle after 6 to 12 days. Following the disappearance of this symptom the plants present a completely normal aspect, while continuing to harbour the virus. ('Smalling disease' has been shown to be transmissible by the white fly, *Bemisia tabaci*, but not through the sap.)

The infected tomato plants developed intracellular inclusions in the form of typical X-bodies and cubical crystals, which were usually most prominent in the epidermal hairs of fresh material mounted in water. The X-bodies are mostly confined to the two lowest cells, one in each cell, lying in close proximity to the nucleus which is enlarged and slightly deformed. The mode of development of the tomato inclusions conformed to Sheffield's description [*R.A.M.*, xi, p. 335]. The X-bodies are usually circular and average 25 μ in diameter. The number and size of the crystals vary in different cells, the larger ones measuring about 6 μ; in some cases they occur in juxtaposition to disintegrating X-bodies.

In inoculation tests with the symptomless virus on the Solanaceae, White Burley, Harrison's Special, and German Samsun tobacco reacted by a pale green mottling spreading from the tip and margin over the entire surface of the inoculated leaves

and eventually involving all the others. As in the case of tomato, the symptoms ultimately disappear, leaving the plants apparently normal. *Solanum nigrum* was the only other plant to respond to inoculation by a faint mottle.

Ten minutes' exposure of the sap of diseased plants to a temperature of 59° C. inactivates the virus, which withstands dilution up to 1 in 10,000 and is still infective in extracted sap after 24 hours at room temperature during January and February at New Delhi.

Van Koot (Y.) & Wiertz (G.). **Onderzoek naar de afstervingstemperatur van enkele voor de plantengroei schadelijke bodem-organismen.** [An investigation of the thermal death points of some soil organisms harmful to plant growth.]—*Tijdschr. PlZiekt.*, liii, 5, pp. 121–133, 6 graphs, 1947. [English summary.]

The thermal death points of a number of soil organisms harmful to glasshouse crops were found to lie within a temperature range of 35° to 80° C. at Naaldwijk, Holland. The relation between the duration of heating (x) and the thermal death point (y) is reasonably well expressed by a curve of the general form $(y-a)\sqrt{x} = b$. After sterilization by steaming the soil should remain covered for three hours. *Fusarium angustum*, *F. solani* var. *martii*, *F. orthoceras* and its var. *longius*, agents of cucumber and melon wilt, succumbed at 70°, *Sclerotinia libertiana* [*S. sclerotiorum*] from chicory and *Verticillium dahliae* from cucumber at 60°, and *V. dahliae* from tomato at 50°. Decontamination of tomato seed from *V. dahliae* may likewise be effected by half an hour's immersion in water at 45° to 50°, which does not impair viability in the slightest degree.

Frezzi (M. J.). **Contribución al estudio del 'damping-off' o enfermedad de los almácigos en República Argentina.** [Contribution to the study of 'damping-off' or seedling disease in the Argentine Republic.]—*Publ. misc. Minist. Agric., B. Aires*, Ser. A, iii, 30, 40 pp., 11 figs., 1947.

The section of this paper relating to the damping-off of pines and *Cupressus* spp. in Argentina caused by *Fusarium bulbigenum* var. *blasticola* has already been noticed from another source [*R.A.M.*, xxvi, p. 138]. Other soil-inhabiting fungi concerned in damping-off are *F. orthoceras* on pine and *Eucalyptus* spp., *F. oxysporum* on *Pinus radiata* and *P. halepensis*; *Phytophthora capsici* on chilli [ibid., xii, p. 535]; *P. citrophthora* and *P. parasitica* on citrus [ibid., xxi, p. 195]; *Pythium ultimum* and *Corticium solani*, both on a large number of plants; *Rhizoctonia dimorpha* Matz [ibid., i, p. 274] on flax; and *Sclerotium rolfsii* on *Brachychiton populneum* and *Phlox*. Only *S. rolfsii*, however, can be identified from external symptoms as it frequently produces a white, compact mass of mycelium in the necrotic region. All the plants under observation, whether naturally or artificially infected, drooped and collapsed, except for various kinds of citrus, which remained erect. *Pythium ultimum* and *C. solani* are the most important agents of damping-off in Argentina, being very widely distributed, followed in order of pathogenicity by *F.* spp., *Phytophthora* spp., and *S. rolfsii*.

Using *Pinus pinea*, *P. nigra* var. *austriaca*, *P. halepensis*, *P. radiata*, *Cupressus macrocarpa* var. *lambertiana*, and *B. populneum* the following procedure gave highly satisfactory control. Boxes filled with a soil and compost mixture were saturated with 2 per cent. formalin (20 to 24 l. per sq. m.) six to eight days before sowing the seed, which had been previously disinfected, mostly by ten minutes' immersion in 1 per cent. mercuric chloride, while 0·5 per cent. copper sulphate, 1 per cent. Bordeaux mixture, and 1 per cent. uspulun dust were used in a few cases. The seed was sown densely, with a spacing of 2 to 3 cm., and when half the seedlings had emerged the surface of the soil was dusted with zinc oxide (216 gm. per sq. m.). Some of the treated boxes were entirely free from damping-off, in others the incidence ranged from 0 to 1·5 per cent., and in none did it exceed 6, with an average

of 4 per cent. Even without soil treatment, very little damage from damping-off was experienced in plantings of *Pinus radiata* and *P. halepensis* at Córdoba, where favourable temperatures and low atmospheric humidity permit rapid germination and growth. In the State citrus nursery at Bella Vista, Corrientes, losses were reduced by the use of well-rotted manure, ample light, and moderate irrigation.

Boudru (M.). **Crumenula abietina Lag. sur les essences feuillues.** [*Crumenula abietina* Lagerb. on broad-leaved trees.]—*Parasitica*, iii, 4, pp. 144–145, 1947. [Flemish summary.]

Continuing his observations on *Crumenula abietina* [*R.A.M.*, xxvi, p. 367], the author presents a list of 16 species of broad-leaved trees on the dead branches of which the fungus has been observed in Belgium.

Miller (P. W.) & Bollen (W. B.). **Walnut bacteriosis and its control.**—*Tech. Bull. Ore. agric. Exp. Sta.* 9, 107 pp., 18 figs., 5 graphs, 1946.

A full account is given of investigations carried out in Oregon from 1930 to 1945, inclusive, into walnut blight (*Xanthomonas juglandis*) [*R.A.M.*, xxv, p. 427; xxvii, p. 104], together with a digest of the known facts concerning the disease. The aspects covered include geographical distribution [*C.M.I. Map* 133], economic importance, symptoms, hosts, morphology and physiology of the causal organism, pathological histology, life-history of *X. juglandis* in relation to pathogenesis, and control.

The disease is primarily one affecting the parenchymatous tissues, the vascular bundles being invaded only occasionally. The bacteria invade through the stomata and are intercellular at first, but later gain access to the cell lumen and develop there. Large cavities are subsequently formed which are filled with bacteria embedded in a slimy matrix. Physiological and histological evidence point to enzymic action, osmotic pressure, and, possibly, asphyxiation as responsible for the death and disintegration of the cellular structure. In the Pacific Northwest, the organism overwinters primarily in diseased buds and, to a less extent, in lesions on stems of the previous year's growth.

The presence of moisture on the host for a suitable period after inoculation is a pre-requisite to infection. The minimal period of wetting necessary for infection was ascertained to vary with the age of the host parts, the extent of water-soaking of the tissues, and the degree of opening of the stomata. Infection of the nuts and leaves occurred 5 and 15 minutes, respectively, after wetting, when they were very young, the stomata wide open, and the tissues more or less water-soaked. Infection took place at 4° to 30° C. for the leaves and 5° to 27° for the nuts. The incubation period, as determined by inoculation experiments, ranged from 5 to 34 days for the nuts and 8 to 18 for the leaves, depending on the age of the host parts and the environmental conditions. Under field conditions the incubation period generally ranged from 10 to 15 days. The host organs passed through a stage of maximal susceptibility, the leaves as they were unfolding and the nuts at the early flowering stage, into a period of increasing resistance. The greater the number of sources of primary inoculum and the more frequent and abundant the rainfall during the early part of the critical period for infection, the greater was the amount of primary infection which determines the subsequent severity of the disease. Secondary infection occurred in successive waves traceable to specific rainy periods. Rainfall was the most important, if not the sole factor concerned in determining incidence locally.

The most critical period for the development and control of epidemics extended from the time the buds had opened sufficiently to allow the bacteria to enter and come into contact with the rudimentary pistillate flowers up to the time when the

nuts were about half-grown. The pre-blossom and blossoming stages are, therefore, the most critical as regards control.

From the evidence obtained in control experiments it is concluded that the only practical method is by spraying or dusting with protectant bactericides. Of 30 different spray materials tested, home-made Bordeaux mixture consistently gave the best results. Under severe epidemic conditions three applications, one at early pre-blossom, one at late pre-blossom, and one at early post-blossom were required for satisfactory control. In the full programme a concentration of 4–1–100 gave as good results as stronger concentrations and caused proportionately less injury. A bibliography of 122 titles is appended.

Roll-Hansen (F.). **Nytt om lokkrusten (Pucciniastrum padi).** [New information concerning flap rust (*Pucciniastrum padi*).]—*Medd. norske Skogforsøksv.*, ix, 4, pp. 504–510, 2 figs., 1947. [English summary.]

In the autumn of 1946 *Pucciniastrum padi* was found to be causing considerable damage to spruce shoots, especially the terminal ones, which assume an S-shaped curve and undergo more or less extensive necrosis, in Norwegian forests and nurseries [*R.A.M.*, xxv, p. 17]. This is believed to be the first observation of natural infection on the shoots, since they usually bear few or no aecidia, the characteristic opening mechanism of which accounts for the common name of 'flap rust'. The rust was transferred by inoculation from spruce tops to bird cherry (*Prunus padus*) leaves, on which uredosori were produced. Control of the disease on spruce consists in the removal of the alternate host.

Large numbers of the aecidia do not open until the second spring after their formation. At this time the aecidiospores are still fully infective, as was shown by inoculation experiments from January to April, 1947, with material from cones dating from 1945. These resulted in the production of numerous uredosori on bird cherry leaves, while the same organs developed more sparsely on those of Reine Claude d'Oullins damson (*P. insititia* var. *italica*).

Gertz (O.). **Einige bemerkenswerte Pilzformen aus den Kohlengruben Schonens.** [Some remarkable fungus forms from the coal mines of Scania.]—*K. fysiogr. Sällsk. Lund Förh.*, xvi, 11, pp. 88–101, 8 figs., 1946.

The mycoflora of coal mines [cf. *R.A.M.*, xx, p. 505; xxii, p. 4, *et passim*] is stated to have been little explored in Sweden. The following observations refer to material collected in Scania in 1935 and 1945, mostly at a depth of 93 m. below soil-level and a constant temperature of 9·5° C., of *Merulius lacrymans*, *Armillaria mellea*, *Lentinus lepideus*, *Lenzites sepiaria*, *Hypholoma fasciculare*, *Paxillus panuoides*, *Coprinus micaceus*, *Daedalea quercina*, *Polyporus* [*Fomes*] *annosus*, *P. caesius*, *P. undatus* [*P. adiposus*], *P. squamosus*, *P. stipticus*, and *Trichosporium* sp. The fungi presented various morphological anomalies resultant on the exclusion of light. For instance, the vegetative portions of the fruit bodies were abnormally elongated and the reproductive system correspondingly reduced, even to complete suppression of the hymenium. Extraordinary malformations were another feature of the fructifications developing in darkness, some species producing *Clavaria*-like coralloid, or morchelloid structures, while in extreme cases fruiting was entirely inhibited.

Baxter (D. V.). **Occurrence of fungi in the major forest types of Alaska.**—*Pap. Mich. Acad. Sci.*, xxxi (*1945*), Part I, pp. 93–115, 18 pl., 5 figs., 2 maps, 1947.

These ecological studies of the part played by fungi in plant succession, made in five different forests in Alaska, are based on the known fact that fungi have a

definite role in the life-cycles of plant communities. They are often directly responsible for changes in the composition of associations of higher plants, and in many instances they affect the rate of change. It seemed evident, therefore, that ecological-pathological studies of the 'normal' fungus cycle in major forest types would aid in planning measures for minimizing losses due to pathogenic fungi. If it is possible to follow the history of a forest environment, with its types of fungus populations, back through various periods of development, it may be also possible to forecast the probable future of certain plant associations, together with their forest fungi. Hence, it should be feasible to gauge with reasonable accuracy what 'pests' will occur in future stands and, perhaps, what effect they will have.

A study was made of the area colonized after the retreat of the glacial sheet in the region of Deadman's Glacier and the Bartlett Glacier near Tunnel, Alaska. A species of willow (*Salix*) is the first woody plant to invade the ice-freed ground, then alder (*Alnus crispa*), and finally mountain hemlock (*Tsuga mertensiana*). It was found that the willow is attacked during its first season by *Melampsora arctica* [*R.A.M.*, xvii, p. 348]. At the glacier front, as in the meandering river belts of the interior [ibid., xviii, p. 642], rust affects the early development of the forest. Seedlings under one year old are infected, and relative susceptibility to rust may be a material factor in the natural thinning of the trees.

When shade and competition become significant among the smaller broad-leaved trees, *Hymenochaete agglutinans* is prevalent on willow, and *Stereum hirsutum*, *Merulius niveus* [ibid., xxvi, p. 517], and *Peniophora aurantiaca* commonly occur on alder. The complete decay of alder is, however, due to *Poria ferrea*, which probably causes more decay of alder throughout Alaska than does *Fomes igniarius* var. *nigricans* [ibid., xxii, p. 184].

In the climax mountain hemlock forest the same species of wood-rotting fungi that induce decay of standing green trees and fallen material in both interior and strictly coastal forests are present, e.g., *F. pini* [ibid., xxvi, p. 272] and *F. pinicola* [ibid., xxvi, pp. 223, 568]. *Aleurodiscus weirii* occurs on [mountain] hemlock in the climax forest. The brown felt fungus *Herpotrichia nigra* [ibid., xxiii, p. 49] occurs more commonly in transects in the Chugach Mountains than in any of the others mapped.

It was observed that the more remote tree-infecting fungi were from the ice, the more numerous they were up to a point where all the species attacking *Tsuga* were present. The largest population appears to be in the 'subclimax' type and just before the forest becomes mostly over-mature hemlock, being determined by the abundance and age of the tree species. For many fungi found on the transect the age of the timber is an important factor. *F. pini* was observed only in the mature stands of hemlock. The size of the wood may bear some significance in relation to the occurrence of certain fungi, *F. pinicola*, for example, appearing only on the large pieces of slash and stumps.

Other sections of this paper deal with forest and fungus succession (*a*) of interior river valleys with meandering streams [ibid., xviii, p. 642], (*b*) where the flora includes species characteristic of both the coastal and the interior forests, (*c*) on Kodiak Island, and (*d*) after the retreat of a glacier in the Pacific coastal region.

MACDONALD (J. A.). **Experiments on the effect of centimetre-length electromagnetic waves on wood-destroying fungi.**—*Ann. appl. Biol.*, xxxiv, 3, pp. 430–434, 1947.

When the mycelia of *Coniophora puteana* and *Merulius lacrymans* were exposed to the beamed radiation from a standard Service radar transmitter giving pulses of radiation of wave-length 9·1 cm., growth of the former fungus on malt agar films on glass slides was retarded and many superficial hyphae were killed. Exposures

up to one hour did not kill the mycelium of either fungus when growing on malt agar slopes or plates, or on wood blocks, though growth was checked whenever drying of the mycelium occurred. It is concluded that the rays have no lethal effect and injure the fungi only through the drying of the mycelium which results from the increase in temperature induced.

Borg (J.). **Erfarenheter vid undersökning av stängelsestolpars varaktighet.** [Observations in connexion with the investigation of the durability of fence posts.]—*Svenska MossFören. Tidskr.*, N.S., ix, 2, pp. 122–133, 1947.

The following are some of the facts ascertained by the writer in the course of his investigations on the factors influencing the durability of fence posts in Sweden. The service life of oak, larch, and pine in dry (moorland-sand moraine) soil was estimated at >25, >15, and 7 years, respectively, and for pine and aspen in fairly damp clay at 4 and 3½, respectively. The corresponding periods assigned to pine with average diameters of 9, 11, 12, and 13·5 cm. (ages 95, 90, 100, and 90 years) were 7, 10, 15, and 20 years, respectively. The practice of encasing the base of the posts in stone, formerly in common use but now largely discontinued owing to labour shortage, was shown to increase the period of serviceability by at least 100 to 150 per cent. In a test to compare the value of various methods of preservation, charring and the application to the posts of wood tar (0·3 kg. per post) raised the service life from 6½ to 13½ years and using asphalt tar to 11 years. The life of the posts encased in stone was 14 years without any treatment; it was extended to >18 by charring and painting with creosote (0·3 kg.), carbolineum, and impregnol (both at 0·25 kg.). In other experiments involving impregnation with copper sulphate, one lot of eight posts was free from rot after 18 years and a total service period of 25 may safely be assumed, compared with 6½ for the controls. Another lot of ten was still in sound condition after 15 years. Experiments are now in progress with arsenic [*R.A.M.*, xxiv, p. 394], which is likely to prove even more toxic to wood-destroying fungi and resistant to leaching than copper sulphate. The economic aspects of the preservation of fence posts are briefly discussed in relation to current prices and local conditions.

Wenzl (H.). **Zur Methodik des Rübenbeizversuches gegen Wurzelbrand.** [On the experimental technique of Beet disinfection against black leg.]—*Arb. biol. Anst. (Reichsanst.), Berl.*, xxiii, 2, pp. 273–278, 2 graphs. [?1940. Received December, 1947.]

As a general criterion for the efficiency of disinfectants in beet black leg (chiefly *Pythium* spp.) control experiments in Austria [*R.A.M.*, x, p. 768], the measurement of the gaps left in the stands by missing plants proved sufficiently reliable. However, where finer distinctions are requisite, for instance, in the relative efficacy of individual preparations, seedling counts, e.g., by Buchholtz's method [ibid., xviii, p. 5], are preferable.

Water blister of Pineapples.—*Qd agric. J.*, lxv, 4, p. 280, 1947.

In order to enable a better control of water blister of pineapples (*Ceratostomella paradoxa*) [*R.A.M.*, xxv, p. 509] to be obtained in Queensland, the disease has been added to the list declared under The Diseases in Plants Acts.

Cut flower quarantine (quarantine No. 74).—*B.E.P.Q., U.S. Dep.Agric.*, 3, pp. 1947.

To guard against the introduction of a *Cercospora* leaf spot, quarantine No. 74, effective as from 1st August, 1947, restricts the entry into the United States of cut flowers from foreign countries to those originating in the Dominion of Canada, Labrador, and Newfoundland.